LAKE AND RIVER ENHANCEMENT FEASIBILITY STUDY FOR JIMMERSON LAKE

Engineering

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Table of Contents

List of Figures

List of Tables

APPENDIX

JIMMERSON LAKE FEASIBILITY STUDY
EXECUTIVE SUMMARY

An Engineering Feasibility Study was performed to address the wetland preservation and erosion control practices for the watershed surrounding Jimmerson Lake in Steuben County in Indiana. Recommendations resulting from the study focus on delaying the eutrophication of Jimmerson Lake and preserving the soil resources in the watershed. These recommendation are as follows:

Sediment Basin

The eastern component of the drainageway, in Section 5 of Pleasant Township, is largely an open valley that receives runoff from approximately one hundred fifty acres. Nearly 90% of this is agricultural land and the remainder is pasture and forested land. Nearly all of the agricultural land, except for the Brookston loam, is potentially highly erodible and nearly ten acres of the subwatershed is highly erodible.

Properly designed and maintained sediment basins can be very effective in preventing sedimentation of downstream areas. Coarse and medium size particles and associated pollutants will settle out in the basin. Suspended solids, attached nutrients, and absorbed non-persistent pesticides may break down before proceeding downstream. Because sediment basins also retain water, they may help recharge the ground water.

A basin with an effective surface dimension of 300 feet by 120 feet is recommended. The minimum volume of the basin to address water quality should be equal to 0.5 inches of runoff from the entire contributing watershed. The volume is calculated then to be 272,250 cubic feet or 6.25 acre-feet. The required depth to obtain this volume is 8 feet.

Conservation Easement

In Section of Pleasant Township, the west component of the same inlet, there are depressional areas that have developed into significant wetland areas. Landward of these areas are forested areas that are generally pristine. However, this tract is scheduled for development and has been platted as the Timber Ridge Estates subdivision. Building lots have been sold for single-family home construction which will result in disturbance to the soils. Nearly all of the soil map units in this subwatershed are either highly erodible or potentially highly erodible.

The existing wetland systems play an integral role in protecting and preserving the quality of the runoff from this inlet as it reaches the lake. It is of primary importance that the in-place wetland systems be preserved to allow them to continue to pre-treat

runoff before it enters the lake. Secondly, the wetlands need to be protected from overloading by sediment laden runoff that can occur when future building lots are disturbed. These wetlands can sustain serious and permanent damage if erosion and sediment control practices are not developed and carefully implemented when building lots are disturbed. An alternative for consideration is the purchase of the wetland areas by the Jimmerson Lake Association to insure the preservation and protection of these resources.

Since this area has already been subdivided and lots sold, a more realistically attainable alternative is procuring a conservation easement on the wetland area.

A conservation easement is a legal agreement a landowner makes to limit the type and amount of development on his property. This is a granting of rights associated with adding improvements to property or otherwise changing its use or character. It is a conservation restriction. It is established with recorded deed restrictions. The restrictions are flexible, and they may be tailored to the needs of individual landowners. However, these restrictions attach to the land and are forever, except for special instances. The land may go from owner to owner, but conservation restrictions must be enforced.

Based on a review of the available plat records at the Steuben County Courthouse, the wetland is on lots 13 and 14 of the Timber Ridge Estates Subdivision. The owners of record are identified as Thomas K & Susan Miller and Luanna Oberlin respectively. More information on conservation easements is included in the Appendix.

Boat Operation Management

This management measure is applicable to protecting the aquatic beds and the shoreline in general of Jimmerson Lake. The Jimmerson Lake Association as well as all boaters using the lake can become involved in efforts to protect sensitive aquatic habitats.

"NO WAKE" buoys should be installed. Four areas are designated for protection. These include:

- Buena Vista Inlet
- Lane 101D Region
- Delphi's Addition Inlet
- DNR area to Public Access Ramp

BMPs

Homeowners

The Jimmerson Lake Association is encouraged to implement a public education program to distribute educational materials to the residents of the Jimmerson

Lake watershed or conduct equivalent outreach activities about the impacts of storm water discharges on water bodies and the steps that the public can take to reduce pollutants in storm water runoff.

Construction Sites

Erosion and sedimentation from construction sites can lead to reduced water quality and other environmental degradation. Municipalities can enact erosion and sediment control ordinances for construction sites. These local regulations are intended to safeguard the public, protect property, and prevent damage to the environment.

Ordinances promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land. Erosion and sediment control ordinances consist of permit application and review, and they can require an erosion and sediment control plan. A number of communities have dealt with construction sites by using an ordinance requiring permits, review and approval, ESC plans, design requirements, inspections, and enforcement. A model ordinance is included in the Appendix.

1.0 INTRODUCTION

An Engineering Feasibility Study was proposed for addressing the wetland preservation and erosion control practices for the watershed surrounding Jimmerson Lake in Steuben County in Indiana. The study is intended to determine the feasibility of:

- Wetland preservation of in-lake wetlands and remaining wetlands and forested areas around the lake. Aquatic plant beds are susceptible to damage caused by wave action. Intensive boating on Jimmerson Lake may be threatening these wetland areas and protection by buoys and/or other measures may be warranted. Landward wetland and forested areas can benefit from structural and non-structural practices to enhance and protect these resources.

- Erosion control practices for vulnerable areas that slope to the lake's shoreline and highly erodible soils throughout the watershed. Especially vulnerable areas were noted west of CR 300 West and shore slopes south of Nevada Mills Road. Erosion control practices include structural methods of minimizing erosion however the management of erodible soils needs to be a focal point for preserving the soil resource as well as the water resource impacted.

1.1 Background

The Clean Water Action Plan, released by the President in February 1998, presents a plan and certain incentives directed toward accelerating the control of nonpoint source pollution in America. States have been requested, as one of the 111 Action Items presented in the Plan, to prepare a Unified Watershed Assessment (UWA). This Assessment is to be developed through the cooperation of state, federal, and local agencies and the public, hence the term "Unified". The Guidance for completing the UWA, published by the USEPA in June 1998, charged the USDA Natural Resources Conservation Service (NRCS) and the state water quality agency (IDEM) with convening the assessment process. What sets this assessment apart from other lists and reports regarding watersheds is the involvement of numerous organizations, the participation of all states, and the recognition of both impaired and healthy watersheds.

The Unified Watershed Assessment, a requirement of the Clean Water Action Plan of 1997, is a multi-agency effort to prioritize watershed restoration needs in each state and tribe. In Indiana, a workgroup appointed by the Watershed Agency Team for Enhancing Resources (WATER Committee) developed the first Assessment in September 1998 for FFY 1999-2000 in accordance with EPA guidelines.

In the first version of the UWA, the workgroup ranked the 8-digit hydrologic unit watersheds according to the present condition of the water in lakes, rivers, and streams. The data provided information about the water column, organisms living in the water, or the suitability of the water for supporting aquatic ecosystems. Each layer of data was partitioned by percentiles into 5 scores, with "1" being indicative of good water quality or minimum impairment, and "5" indicating heavily impacted or degraded water quality.

Scores for each 8-digit watershed were compiled, and the watersheds were sorted into four categories as required by the USEPA guidance. The four categories are as follows:

- Watersheds in need of restoration: waters do not meet designated uses or other natural resource goals. 25% or more of the waters that have been assessed do not meet state water quality standards. (Note that in some watersheds, only a very small percentage of waters have been recently assessed.)

- Watersheds that on average meet state water quality goals and require attention to sustain water quality. In most of these watersheds, there is habitat which is recognized as critical for threatened or endangered species.

- Watersheds with pristine or sensitive aquatic systems on federal or state managed lands.

- Watersheds with insufficient data to make an assessment.

The Assessment targeted 11 eight-digit hydrologic units for restoration funding during 1999-2000. (Little Calumet-Galien, Kankakee, Iroquois, St Joseph-Lake Michigan, St Marys, Wildcat, Upper White, Eel-Big Walnut, Lower White, Patoka, Middle Ohio-Laughery, and Highland-Pigeon.)

Jimmerson Lake, in northern Steuben County, is in the Crooked Creek- Lake James/ Jimmerson Lake subwatershed of the St. Joseph- Lake Michigan eight-digit hydrologic unit. The Jimmerson Lake Association received funding from the Indiana Lake and River Enhancement program of IDNR in August 2002. The grant was used to conduct a preliminary diagnostic study of the lake with the goal of helping the lake association effectively manage the lake's resources.

1.2 Scope of Study

The scope of the study encompasses the Jimmerson Lake watershed which is approximately 4 square miles in size excluding the contributing watershed of Lake James.

The watershed has an abundance of wetlands and other aquatic resource diversity which is above the average for Indiana. Much of the remaining undeveloped shoreline has been designated as significant wetland or of special concern by the Indiana Dept. of Natural Resources. The exotic aquatic Eurasian watermilfoil have invaded the lake but are not yet well established.

Potential problems and possible solutions identified in this study included the following:

The local watershed includes a high percentage of soils on steep slopes immediately surrounding the lake. These soils are highly at risk of erosion at any time when vegetation is disturbed or destroyed. During periods of disturbance, these soils could contribute to sediment and nutrient loading to the lake. Erodible soils need to be managed carefully.

Water samples of stormwater runoff from the Buena Vista neighborhood on the north side of the lake had high nutrient and sediment concentrations. Elevated loading rates from stormwater need to be addressed.

Jimmerson Lake has higher than average watercraft usage when compared to other Indiana lakes. High speeds and speeding in near-shore areas play a major role in disrupting the stability of aquatic vegetation beds along the shore and in other shallow areas.

A growing number of concrete or other hard surface seawalls are being installed on shoreline properties. These structures divert wave actions instead of absorbing the energy. The result is increased damage by erosion to adjacent shorelines and loss of habitat for aquatic species.

The lake reportedly has a diverse population of rare biological resources that rely on the wetlands and forested lands near the lake shore. Since the pressure of development would eradicate those areas, plans for acquiring sensitive areas and/or protecting them through conservation easements should be considered.

Protecting the resources of Jimmerson Lake and other lakes in the extended watershed is an attainable goal while restoration efforts are far less likely to be feasible and effective. A proactive stance of land use and water resource planning in the form of a lake management plan is preferred instead of reactive measures to address problems after they develop.

1.3 Objectives

The objective of this feasibility study is to further examine the possible solutions presented in the diagnostic study. Consideration is to be given to four categories of structural and non-structural methods of protecting the resources of Jimmerson Lake. These include:

- Inlet Protection
- Storm sewer inlets
- Boat operation management
- Best Management Practice guidelines for development

2.0 STUDY AREA

2.1 Location

The watershed is situated in Steuben County, Indiana in the civil townships of Jamestown and Pleasant. Nearly all of the lake lies in the Jamestown Township with the exception of the inlet from the south, by Lane 150, which is in Pleasant Township.

The catchment area includes parts of Sections 19, 20, 29, 30, 31, and 32 in Township 38 North, Range 13 East (Jamestown Township) as well as part of Sections 5, 6, and 8 in Township 37 North, Range 13 East (Pleasant Township).

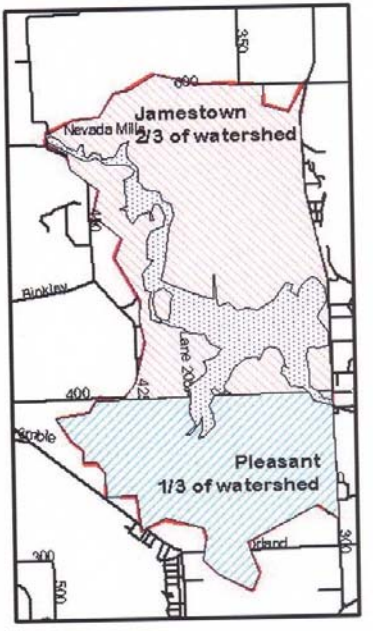

Figure 1 Civil Townships of Watershed

2.2 Geologic History

Central Indiana is the physiographic region referred to as the Tipton Till Plain, the flat to gently rolling surface that is the product of continental glaciation during the Ice Age. Sediments borne by the ice sheets were deposited as till (an unsorted mixture of sand, silt, clay and boulders) when the glaciers advanced into Indiana and as

outwash sand and gravel when the ice melted. Thick accumulations of till and outwash filled the bedrock valleys and covered the bedrock hills of northern Indiana to produce the flat to gently rolling landscape.

Parts of glaciated Indiana, however, are hilly with many features of relatively high relief throughout. The Northern Moraine and Lake Region of northeastern Indiana typifies this kind of terrain. The same glaciers that masked relief on the bedrock surface also produced the bold upland surfaces of Steuben Counties. Part of the topographic expression is the result of moraine formation by active ice and by the overspreading of the region with ablation or flow till that formed during times of glacial retreat. Large depressional areas, some of which contain lakes, form when large blocks of the melting glacial ice are buried beneath outwash sediments. With time, the buried ice blocks melt leaving behind lakes.

The hydrogeologic setting for the lake itself is predominantly the Jamestown Lake James trough system. The Buena Vista neighborhood and the area to the north is part of the Jamestown Fawn River sluiceway. Other settings are shown in the figure below including the Huntertown ablation sequence and collapsed ridge-ice complex. An ablation sequence is a surface feature that results following snow or ice melting or evaporation.

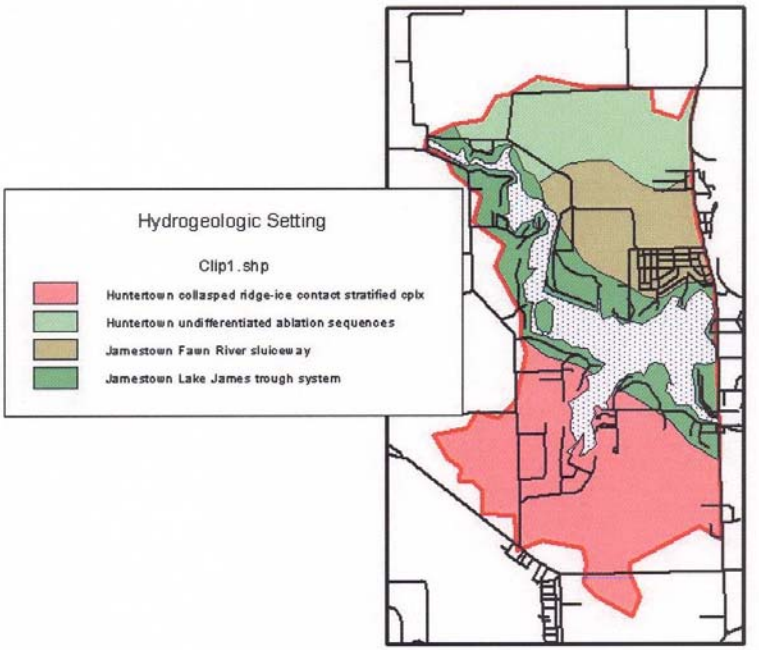

Figure 2 Hydrologic Units of Watershed

2.3 Lake

Jimmerson Lake is a natural lake that is approximately 380 acres in size. The lake has three significant basins with the largest one having a maximum depth of 56 feet. There is one primary inlet, which is from Lake James. The inlet, at County Road 300 West, represents the discharge of some 48 square miles of watershed in the Lake James Chain.

There are about ten other minor inlets that are surface conveyances of runoff. Development of a watershed typically has an adverse effect on the runoff in terms of sediment and nutrient loading, peak flows, and temperature increases. Despite an increasing number of shoreline homes and much higher watercraft usage, water quality of Jimmerson Lake reportedly appears to have improved significantly over the past fifty

years. Nutrient levels are lower and Secchi disk readings are higher than most Indiana lakes.

Jimmerson Lake has a vigorous fish community that is not plagued by exotic species such as carp. The endangered cisco population is believed to be lost. The Indiana Dept. of Environmental Management has categorized the lake as "impaired" due to a fish consumption advisory for mercury. The source of this mercury is thought to be associated with airborne sources rather than inputs in the local watershed.

2.4 Watershed

The Jimmerson Lake watershed encompasses approximately four square miles, or about 23% of the Crooked Creek- Lake James/ Jimmerson Lake watershed. The larger watershed refers to the 14- digit hydrologic unit code 04050001090030 that is part of the St. Joseph River- Lake Michigan hydrologic unit. The watershed is situated in Steuben County, Indiana.

The watershed for Jimmerson Lake is approximately three miles long (north to south) and varies in width from one to one and one-half miles. The most distant fringes of the watershed are just over one mile from the shoreline. There are some 800 permanent and seasonal residences with shoreline property or lake access. While there are no incorporated towns in the watershed, the area is becoming increasingly "urban" with the pressure of residential development- especially near the lake.

2.4.1 Soils

According to the Soil Survey of Steuben County, Indiana, there are thirty seven different soil map units identified in the Jimmerson Lake watershed. This includes 19 different soil series. Many of those soils that occur on slopes are further divided into separate units based on the degree of slope. The graphic below represents the different soil map units identified in the watershed.

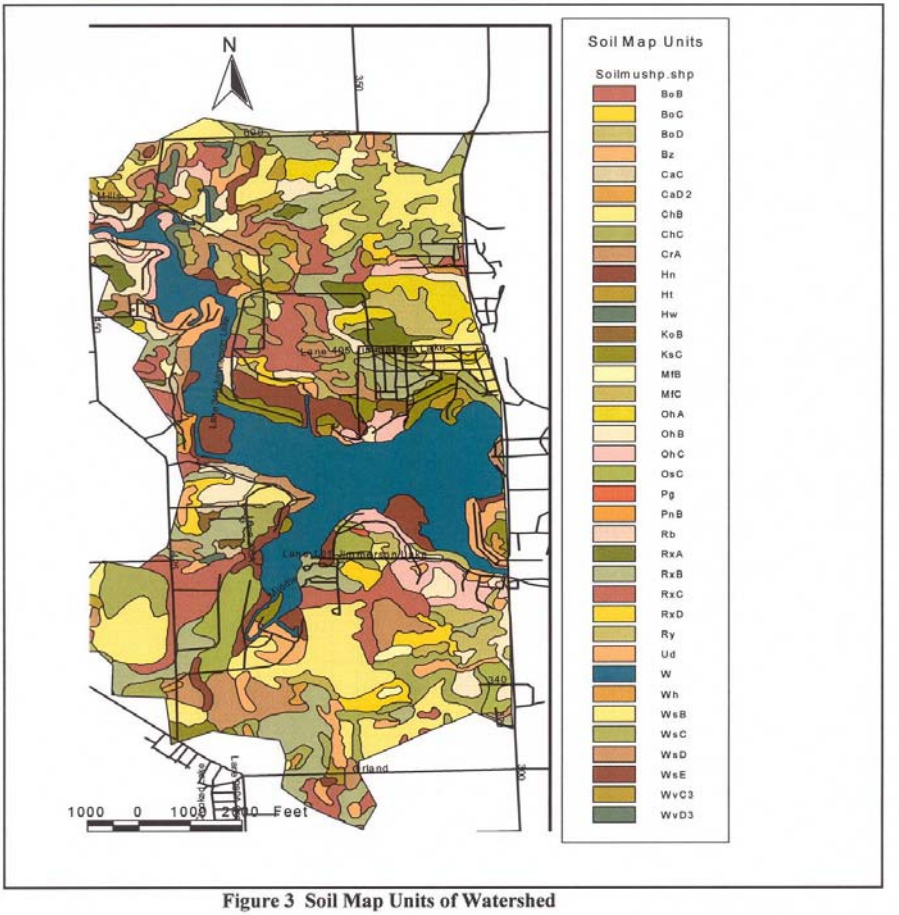

Figure 3 Soil Map Units of Watershed

Soils

Soil is developed through physical and chemical weathering of a thin surface layer of rock and mineral fragments (soil parent material). Soil texture, structure, depth, and fertility determine what kind of plant life a soil can support and what its infiltration rate, percolation rate, and water holding and water storage capacities will be. Soil texture and structure determine the erosiveness of soils. Texture is the proportion of mineral particles of various sizes in the soil; structure is the degree of aggregation of these particles.

In order of decreasing particle size, soil texture classes are sand, silt, and clay. Sand particles are visible to the naked eye; individual silt and clay particles are visible only under the microscope. Sandy soils are referred to as coarse textured, loamy soils as medium textured, and clay soils as fine textured. Generally, soils composed of coarser particles drain water more rapidly than soils composed predominantly of finer particles. Sandy soils allow fast water infiltration and percolation, but little storage; clay soils allow slow infiltration and percolation and greater storage. Sand, silt, and clay are easily eroded if the particles are not bound into stable aggregates. Organic materials and colloidal clays are primary cementing agents. Soils high in clay content and organic material are among the least erodible and most fertile soils. Sandy soils low in clay and organic material tend to have high erosion rates.

Good soil structure contains much airspace, which allows ready water infiltration into the soil, water percolation through the soil, and higher water storage capacity. Soils that have blocky or prismatic aggregates or that contain a high fraction of gravel (rock fragments larger than 2 mm) have higher infiltration rates than soils that are platy, such as most clay soils, or granular, such as some loamy soils.

Although geological relationships are too complex to analyze here, review of some geologic terms and principles should clarify the direct implication of geology in slope management. The types of rock and parent material present are good indicators of the weathering of rocks, the soil-forming processes, and erosion. The rock hardness, the size of the crystals, and the degree of crystal bonding and cementation are all important factors. For example, many granitic rocks erode rapidly because of weak crystal cohesion and large crystal size. This makes our granitic soils highly erodible. Rhyolite rocks weather more slowly, producing finer crystals, and soils derived from these rocks are therefore less erodible. Basalt rocks have even finer crystals that weather very slowly and soils derived from these rocks are less erodible still.

Generally, metamorphic rocks (rocks that were altered in form under extreme heat and pressure) are harder than igneous rocks (rocks formed by cooling and solidification of molten lava) and sedimentary rocks (rocks which were broken down by weathering and deposited by water, wind, and gravity and then consolidated by heat or pressure or cemented by silica, lime, or iron solutions).

Erosion Factors

Erosion is the product of six factors: soils, climate, vegetation, animal activity, topography, and human activity. The climate, the degree of slope of the land, and the soil physical characteristics cannot be directly controlled to reduce soil erosion, but can

be modified through soils engineering, whose principal aim is to change slope characteristics so that the amount and velocity of runoff is lessened.

Climate

The major climatic factors in erosion are precipitation, temperature, and wind. Precipitation, viewed as the interplay of amount, intensity, and duration, rather than as average rainfall, is the greatest erosional factor. The first rainfall after a dry period saturates a bare soil surface, causing little erosion. After that, raindrops hit the soil-water surface, causing breakdown of the soil aggregates. Splashing causes muddy water, in which the smaller soil particles are held in suspension. When this muddy water enters the soil, the pores become clogged; infiltration slows down and may almost stop. Amount and velocity of runoff are increased, causing surface erosion, rills, and finally gullies. If the runoff water is concentrated long enough on a particular portion of a slope, the soil becomes saturated and mud flows result.

Five of the soil map units are categorized as highly erodible soils and they account for 4% of the watershed area. However, another eighteen (18) soil map units are designated as potentially highly erodible. This second category accounts for 61% of the watershed. The potentially highly erodible and the highly erodible categories make up two-thirds of the watershed.

Table 1 Percentages of Erodible Soils

Soil Erosion Potential	Percentage of Watershed
Not highly erodible	35
Potentially highly erodible	61
Highly erodible	4

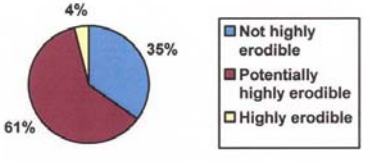

Figure 4 Proportions of Erodible Soils

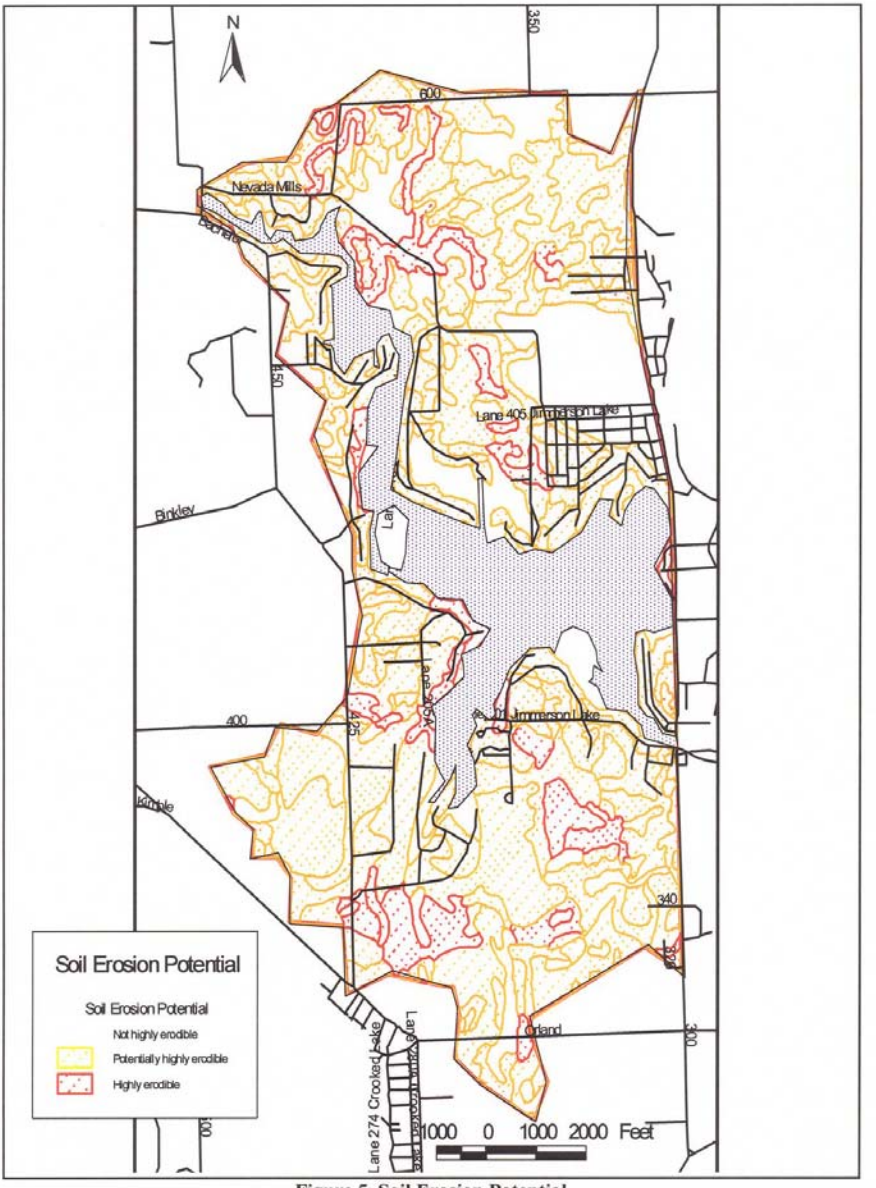

Figure 5 Soil Erosion Potential

2.4.2 Landuse

The Jimmerson Lake ecosystem receives pressure from the impacts of agriculture and urbanization in the watershed. Prior to settlement and development, the area was a mix predominantly of natural deciduous forest and wetlands. Settlers transformed much of the landscape by clearing forests and draining wetlands. As agricultural practices and technology advanced, surface and subsurface drainage systems were installed. Many of these however, are at the expense of water quality as stream corridors and runoff patterns are modified.

The trend in crop production continues for larger equipment requiring larger fields and fewer fence rows. The result is less natural filtering and increased runoff rates.

Urban development also continues to subject the lake system to water quality degradation. The sanitary sewer collection system is a milestone toward reducing the impacts of urbanization, as on-site disposal systems, typically septic tanks, are known to have high failure rates, in this watershed as well as throughout the state of Indiana.

While the sanitary sewer collection system addresses the sewage impacts from development, other impacts continue to increase. These include impacted runoff from paved areas such as roads and other impervious areas including roofs and other constructed improvements. The image below provides a composite view of the watershed by landuse based on four general categories that include:

- Agriculture
- Deciduous forest
- Urban
- Wetland

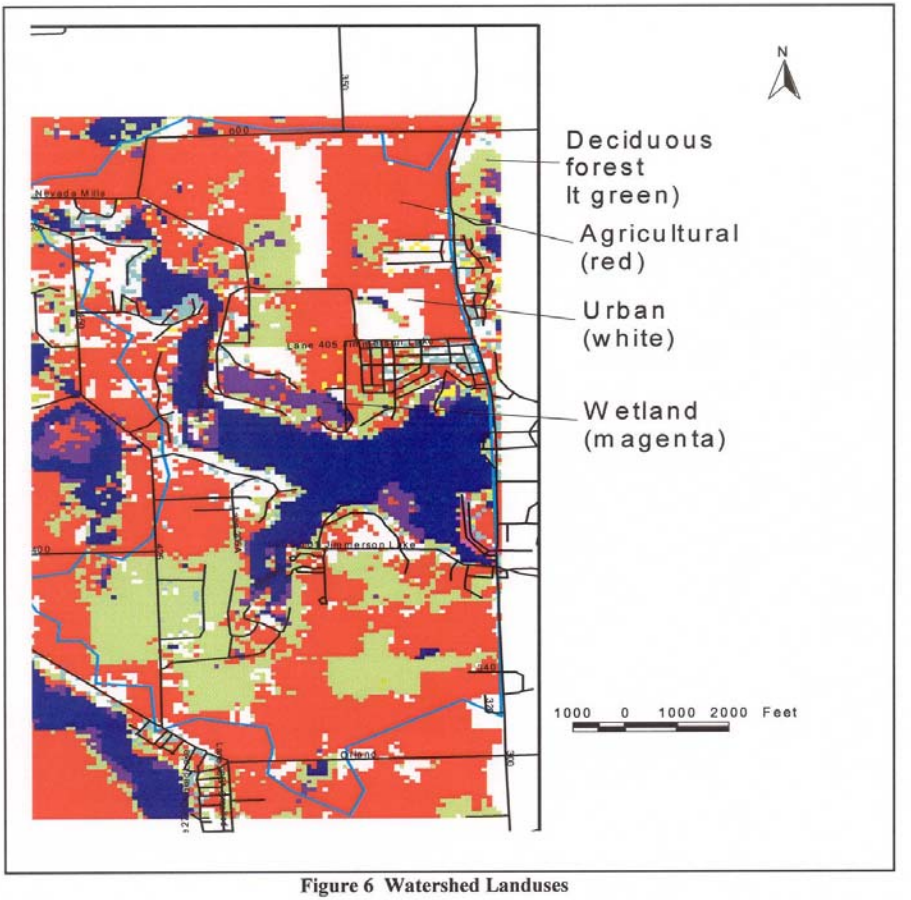

Figure 6 Watershed Landuses

3.0 PROJECT FEASIBILITY ANALYSIS

The objective of this feasibility study is to further examine the possible solutions presented in the diagnostic study. Consideration is to be given to four categories of structural and non-structural methods of protecting the resources of Jimmerson Lake. These include:

Inlet Protection
Storm sewer inlets
Boat Operation Management
Best Management Practice guidelines for development

3.1 Inlet Protection

Inlets to Jimmerson Lake are diverse and complex. Two large subwatersheds represent the Jamestown Fawn River sluiceway from the north and the Huntertown collapsed ridge ice contact stratified complex from the south. Most of the other inlets have subtle features and are not well defined. A total of seven inlets were examined for consideration as construction sites for structural measures. These seven sites were selected based on their catchment area size and known activities in the subwatersheds that have potential for detrimental impacts to water quality. The seven inlets sites are identified according to the adjacent subdivision or public roads. The table below summarizes the inlets.

Table 2 Watershed Inlets Reviewed

Inlet	Subwatershed size (acres)
Buena Vista	30
Lane 150	150
Co Rd 450	20
Bachelor Rd	7
Nevada Mills Rd	200
Lane 340	210
Lane 350	50

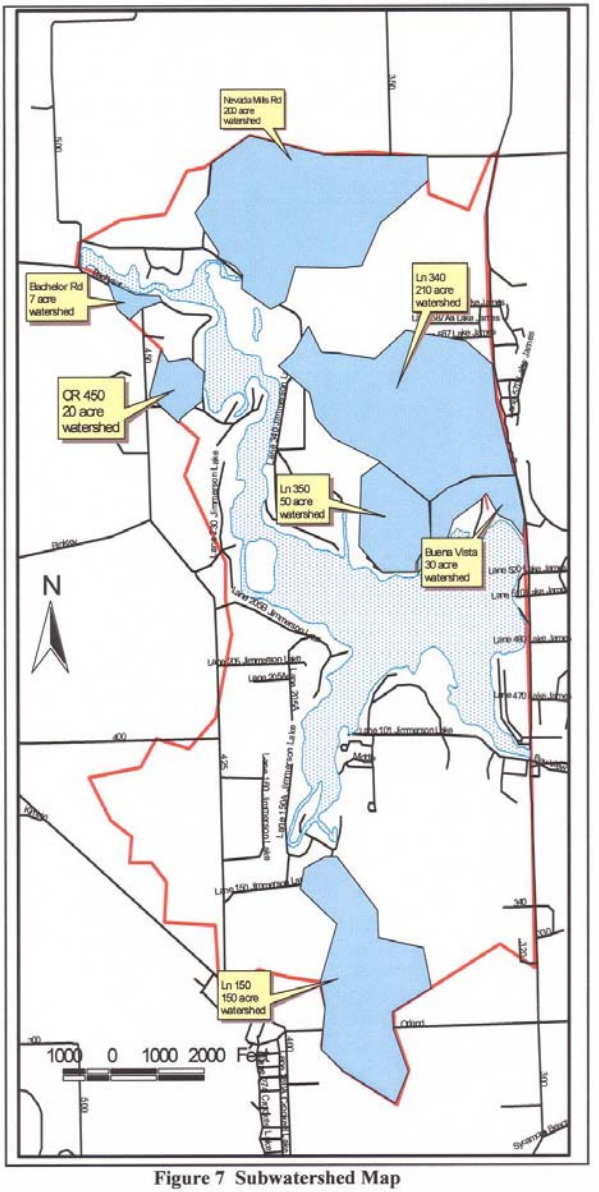

Figure 7 Subwatershed Map

3.1.1 Buena Vista

The Buena Vista neighborhood includes an estimate of approximately 150 residential structures comprised of permanent and temporary homes. As stated earlier, a sanitary sewer collection system has been installed to collect sewage from these units. In the past, these units were all served by on-site sewage disposal systems (typically septic tanks) however the newly installed collection system had eliminated the source of pollutants associated with failed septic systems.

Soils in this area are categorized as potentially highly erodible. Undisturbed residential lots with healthy lawn grass vegetation help to control soil losses on these slopes. When that vegetation is not maintained or the sites are disturbed however, the contributions of sediment can be substantial.

The field survey of the Buena Vista area noted localized bank erosion and numerous instances of sediment deposition. Lane 425 generally follows the bottom of the slope in this inlet area and Lane 425B extends to the delta that has formed from the mouth of the lake. The delta is the result of unchecked erosion since the lake was formed however the erosion processes continue.

There is some natural vegetation filtering in this valley however sediment transport to the lake is readily apparent. The catchment area at the mouth of this valley, north of Lane 425, is approximately eight acres.

Alternatives for addressing the sediment transport, and the associated nutrients bound to the sediment particles, were considered for this region. These include

1. Intercept sediment transport with a sediment basin.
2. Rely on non-structural measures to minimize sediment displacement.
3. No action.

The first alternative involves the installation of a sediment basin in the valley area north of Lane 425. This basin would be effective in collecting runoff from the catchment area and provide for sediment deposition from sediment laden runoff. The basin would also dissipate the energy and reduce the runoff velocities. These features would also provide benefit in that sediment loss from the immediate valley area would be reduced.

The second alternative relies on non-structural measures (Best Management Practices) to reduce the loss of sediment and the sediment associated nutrients. The measures can be further divided into permanent and temporary measures. An effective permanent measure includes the propagation and maintenance of permanent vegetation.

Grass vegetation with a goal of 100% ground cover is effective at reducing sediment loss and filtering runoff to capture sediment and nutrients from contributing areas.

Temporary measures in the second alternative target erosion and sediment control when disturbance of the soil is necessary. Most of the Buena Vista neighborhood is developed and consequently does not have significant numbers of lots or building sites with disturbed and exposed soils. Whenever new construction or improvements are initiated however, the lack of effective erosion and sediment control planning results in irreversible loss of soil and damage to the lake. While these losses are temporary, they are cumulative. Their collective impact is well demonstrated by the delta that is in place. The delta occupies nearly ten acres of space, having been built by soils transported from the larger watershed area which is some thirty acres.

The final alternative is to take no action and let nature take its course. This statement is, in fact, incomplete. The sentence would be more accurate to say "let man's nature take its course". Even though the delta formed prior to man's settlement and development, the disturbances associated with this development accelerate the sediment transporting processes.

Alternative 1, the sediment basin, would need to be constructed on the west side of the valley to avoid encroachment on private property. The west side of the valley is the site of the Buena Vista Property Owners Association. The property includes a club house and outdoor recreational areas on approximately one and one-half acres. The catchment area for this portion of the inlet area is approximately 8 acres. Sedimentation depends on providing adequate residence time of runoff in the basin for soil particles, especially sand and silt, to be deposited. The basin will need to have a storage capacity of approximately 0.5 acre-feet to provide the required residence time to encourage sediment deposition. This volume could be obtained by constructing a basin that has a surface area of 0.2 acres (130 ft by 70 feet) with an average depth of 2.5 feet.

Due to the slope and shape of the potential construction site, the construction of a basin at this location would require significant excavation. Soil material would need to be cut from the valley's west slope to construct an embankment along the upgradient side of Lane 425. Construction of an embankment with 2:1 upgradient and 3:1 downgradient side slopes would be specified to avoid creating a hazard to the public. Construction of such an embankment in this location is likely to be cost prohibitive due to an excessive quantity of fill relative to the design capacity of the basin. In addition, use of the site will encroach on the usable area remaining for the Buena Vista Property Owners Association activities. For these reasons, alternative 1, the sediment basin, is determined not to be feasible at this time.

3.1.2 Lane 150

The main inlet system on the south side of the lake is fed by two separate drainageways. For convenience, they will be referenced according to the township sections they are found in. The west drainageway is in Section 6 of Pleasant Township while the east component is in Section 5.

3.1.2.1 Wetland Protection

In Section 6, the west component, there are depressional areas that have developed into significant wetland areas. Landward of these areas are forested areas that are generally pristine. However, this tract is scheduled for development and has been platted as the Timber Ridge Estates subdivision. Building lots have been sold for single-family home construction which will result in disturbance to the soils. Nearly all of the soil map units in this subwatershed are either highly erodible or potentially highly erodible.

The existing wetland systems play an integral role in protecting and preserving the quality of the runoff from this inlet as it reaches the lake. It is of primary importance that the in-place wetland systems be preserved to allow them to continue to pre-treat runoff before it enters the lake. Secondly, the wetlands need to be protected from overloading by sediment laden runoff that can occur when future building lots are disturbed. These wetlands can sustain serious and permanent damage if erosion and sediment control practices are not developed and carefully implemented when building lots are disturbed. An alternative for consideration is the purchase of the wetland areas by the Jimmerson Lake Association to insure the preservation and protection of these resources.

Since this area has already been subdivided and lots sold, a more realistically attainable alternative is procuring a conservation easement on the wetland area.

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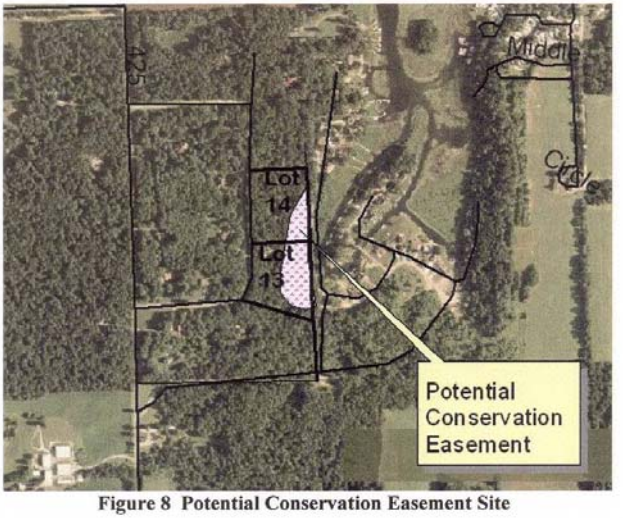

Figure 8 Potential Conservation Easement Site

3.1.2.2 Sedimentation Basin

The eastern component of the drainageway, in Section 5, is largely an open valley that receives runoff from approximately one hundred fifty acres. Nearly 90% of this is agricultural land and the remainder is pasture and forested land. Nearly all of the agricultural land, except for the Brookston loam, is potentially highly erodible and nearly ten acres of the subwatershed is highly erodible.

Properly designed and maintained sediment basins can be very effective in preventing sedimentation of downstream areas. Coarse and medium size particles and associated pollutants will settle out in the basin. Suspended solids, attached nutrients, and absorbed non-persistent pesticides may break down before proceeding downstream. Because sediment basins also retain water, they may help recharge the ground water.

Although erosion control should always be considered first, in those situations where physical conditions or land ownership prevents implementation of erosion control measures, sediment basins offer the most practical solution to the problem. It is practical and economical to locate sediment basins where the largest storage capacity can be

obtained with the least amount of earth work, such as in natural depressions and drainage ways. A sediment basin is an alternative for consideration in this drainageway.

Preliminary Design

To be effective at removing sediment from the runoff, sediment basins must be designed with adequate surface area and total volume. The efficiency of sediment deposition is affected also by the configuration. Recommended configurations are lengths (L) that are at least twice or three times the width (W) dimension. An accepted principle for determining the surface area of the basin is related to the peak runoff rate for a design storm event.

The peak runoff rate (Q), based on a 10-year reoccurrence frequency, is calculated to be approximately 80 cubic feet per second (cfs) for this subwatershed. The surface area requirement in acres (A) is calculated by the formula:

$A = 0.01 \times Q$

Therefore;

$A = 0.01 \times 80 = 0.8$ acres

Configuring the basin with an $L = 2.5\ W$ ratio, the W is calculated:

$0.8 \text{ acres} = 34{,}850 \text{ ft}^2 = 2.5\ W^2$

$14{,}000 \text{ ft}^2 = W^2$

$120 \text{ ft} = W$

The length is then calculated

$L = 2.5\ W = 300$ ft

The result is a basin with surface dimension of 300 feet by 120 feet.

The minimum volume of the basin to address water quality should be equal to 0.5 inches of runoff from the entire contributing watershed. The volume can be calculated then by:

Cubic feet = 0.5 in/A x 150 A x ft/12 in x 43,560 ft^2/A

= 272,250 or 6.25 acre-feet

The required depth to obtain this volume is:

6.25 acre-feet/ 0.8 acre = 8 feet

The image below depicts the principles of a sediment basin

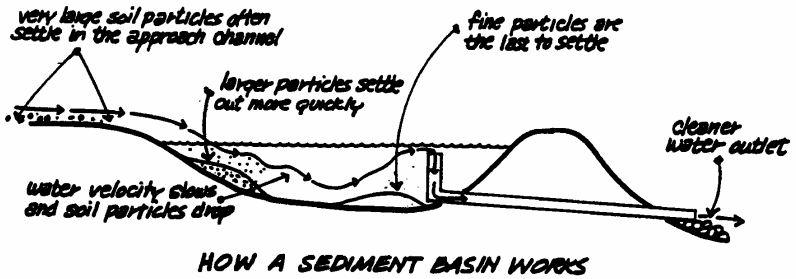

Figure 9 Sediment Basin Conceptual Drawing

Figure 10 provides the conceptual design of the basin's embankment and outlet controls.

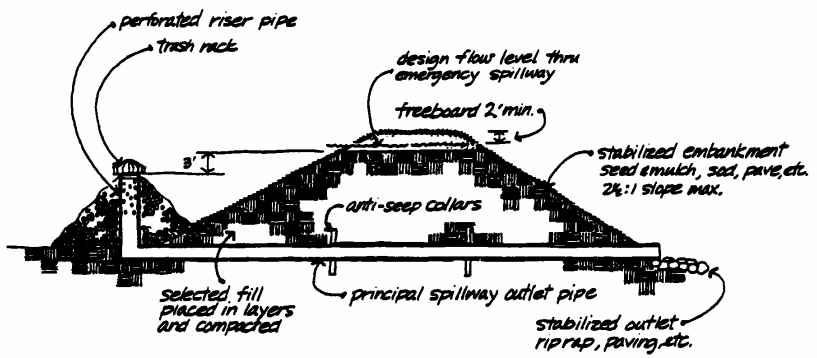

Figure 10 Sediment Basin Embankment & Controls

This section presents approximate sizing and conceptual design of a sedimentation basin for the inlet as an alternative. If selected for installation, final plans will need to be designed by a qualified, registered engineer.

Permit Requirements

The sedimentation basin as an alternative may require environmental permits. Given the relatively small size of the subwatershed, (less than 1 square mile) the project should be exempt from a Construction in a Floodway permit from IDNR- Division of Water. The project would likely require a Lowering of Ten Acre Lakes Act permit from that agency however.

Other agencies that may have permit authority include the U.S. Army Corps of Engineers-Detroit District and the Indiana Dept. of Environmental Management. IDEM may need to issue a Water Quality Certification to authorize the project.

Costs

The Environmental Protection Agency released the Preliminary Data Summary of Urban Stormwater Best Management Practices report in August of 1999. The study is based largely on existing literature and data on best management practices that are used to control urban storm water runoff. Topics covered include: BMP performance measures and measurable goals, availability of measurement methods, design criteria, monitoring issues, costs and cost minimization opportunities, and the benefits and economic impacts of constructing and operating BMPs.

The study stated that the costs for structural measures such as sedimentation basins are largely influenced by size. Three formulas that were presented for determining the construction costs were relied upon to predict the cost for this sedimentation basin.

Table 3 Sediment Basin Cost Projections

Basin Capacity (V)	Cost Equation	Source	Cost
270,000 cu. ft.	$7.75V^{0.75}$	Wiegand et al, 1986	$92,000
-	$18.5V^{0.70}$	Brown and Schueler, 1997	$117,000
-	$7.47V^{0.78}$	Brown and Schueler, 1997	$129,000

The site for the basin is owned by Tree Harbour Enterprises, according to plat records at the Steuben County Court House.

3.1.3 Co Rd 450 West

Another inlet area examined is east of County Road 450 West. This small subwatershed enters the lake at the north end of the Jimmerson Shores Mobile Home Park. The catchment area is approximately twenty acres in size and is approximately equally split between residential and undeveloped land. The development in this subwatershed is concentrated on the lakefront property while undeveloped acreage is to the west.

Due to the heavy concentration of residential units (mobile homes), the runoff from this area would benefit from pretreatment. A sediment basin or other structural measure such as a wetland or filter strip would help reduce nutrient levels from the residential area however construction sites are not available. Installation of any such measure in the undeveloped areas of the watershed would not be productive since these undeveloped areas are all upgradient and the structure would not receive the runoff from the areas that should be targeted for pretreatment. Therefore, it is not feasible at this time to install a structural, such as a sediment basin, in this subwatershed.

3.1.4 Bachelor Road

Along Bachelor Road and Lane 275, another small watershed was studied for possible installation of a structural storm water control measure. The Ramblin Acres community is an extended development along the lake front and the watershed examined is typical of the small catchment areas in that area.

This watershed is approximately seven acres in size. Due to the subtle fluctuations in the surface topography, the drainage patterns are generally random and indistinct. Much of the runoff occurs as sheet runoff and it would be difficult to locate a basin or other structural control that would collect a significant percentage of the runoff. These areas are not considered feasible, at this time, for installation of structural measures to control and pretreat runoff.

3.1.5 Nevada Mills Road

To the northeast of Nevada Mills Road and south of County Road 600 North, there is a subwatershed that is approximately 200 acres in size that is nearly totally agricultural. This subwatershed accounts for the majority of the Huntertown ablation sequence and collapsed ridge-ice complex. The surface features that resulted following snow and ice melting or evaporation are more diverse than some other subwatersheds of the lake. This watershed has more distinct upland, side slope, and lowland areas than other subwatersheds.

The side slope areas have soil map units mapped as Wawasee loam and sandy clay loam. These slopes range from 12% to 25% slopes and the soils are rated as highly erodible. All of the upland soils in this subwatershed, which have surface slopes greater than 2%, are categorized as potentially highly erodible.

The lowland area of this subwatershed has Houghton muck soil. These are organic soils that are deep and very poorly drained. Their features and position in the landscape severely limit their use for agricultural production. Consequently, these soils have been allowed to function as wetland areas that are effective in controlling the runoff and providing pretreatment in terms of sedimentation and nutrient assimilation. The natural wetlands and excavated impoundments in this subwatershed preclude the need for additional structural control measures.

3.1.6 Lane 340

Another subwatershed considered for a structural control measure is the 210 acre catchment area that drains toward the lake near the intersection of Nevada Mills Rd. and Lane 340. While the majority of the watershed is agricultural, a significant amount, approximately forty acres, is the Buena Vista community. The Buena Vista component is on the fringe of the watershed and most of this runoff occurs as sheet runoff into the agricultural land.

The upland agricultural land in this subwatershed is predominantly prime farmland with a surface that has a slope of less than 2%. These soils are not highly erodible.

The lowland area of this subwatershed also has Houghton muck soil. As discussed in the previous subwatershed, this soil map unit creates a natural setting for sedimentation and nutrient assimilation from upgradient runoff. These soil features that are beneficial for stormwater pretreatment are actually discouraging for development. Therefore, the existing lowland vegetation and depressional features of the soil are already accomplishing stormwater sediment and nutrient attenuation and disturbance for installation of additional structural measures is not feasible.

3.1.7 Lane 350

An additional small watershed, of approximately seventy acres in size, was examined. This are receives drainage from the west side of the Buena Vista community and drains to the Jimmerson Cove inlet area west of Lane 350.

The subwatershed, similar to ones previously reported, has upland soils that are potentially highly erodible or categorized as highly erodible. Wawasee loam soils with

slopes up to 18% are on the side slopes however these slopes are not in on-going row crop production.

Houghton muck soils are also in the lowland areas of this watershed. Their features help to encourage sedimentation and nutrient assimilation. Since these soils are generally not suitable for crop production or development, their best use is already being utilized and attempting to site a stormwater control structure, such as a sediment basin, would serve no purpose. The alternative for this, and the two subwatershed discussed prior, is to take no action. The wetland functions in these watersheds, however, need to be protected. To protect from future disturbance, these resources may need to be preserved by way of a conservation easement.

3.2 Storm Sewer Inlets

A variety of products for storm water inlets known as swirl separators, or hydrodynamic structures, have been widely applied in recent years. Swirl separators are modifications of the traditional oil-grit separator and include an internal component that creates a swirling motion as storm water flows through a cylindrical chamber. The concept behind these designs is that sediments settle out as storm water moves in this swirling path. Additional compartments or chambers are sometimes present to trap oil and other floatables. There are several different types of proprietary separators, each of which incorporates slightly different design variations, such as off-line application. Another common manufactured product is the catch basin insert.

Applicability

Swirl separators are best installed on highly impervious sites. Because little data are available on their performance, and independently conducted studies suggest marginal pollutant removal, swirl separators should not be used as a stand-alone practice for new development. The best application of these products is as pretreatment to another storm water device or in a retrofit situation where space is limited. There are few storm sewer inlets within the watershed therefore these devices would have limited application at this time.

Limitations

Limitations to swirl separators include:

- Very little data are available on the performance of these practices, and independent studies suggest only moderate pollutant removal. In particular, these practices are ineffective at removing fine particles and soluble pollutants.
- The practice has a high maintenance burden (i.e., frequent cleanout). This is a major limitation in the Buena Vista and Timber Ridge Estates communities. Maintenance would fall back on the Steuben County Highway Department.
- Swirl concentrators are restricted to small and highly impervious sites.

Sitting and Design Considerations

The specific design of swirl concentrators is specified by product literature available from each manufacturer. For the most part, swirl concentrators are a rate-based design. That is, they are sized based on the peak flow of a specific storm event. This design contrasts with most other storm water management practices, which are sized based on capturing and storing or treating a specific volume. Sizing based on flow rate allows the practice to provide treatment within a much smaller area than other storm water management practices.

Maintenance Considerations

Swirl concentrators require frequent maintenance (typically quarterly). Maintenance is performed using a vactor truck, as is used for catch basins. In some regions, it may be difficult to find environmentally acceptable disposal methods. The sediments may not always be land-filled, land-applied, or introduced into the sanitary sewer system due to hazardous waste, pretreatment, or groundwater regulations. This is particularly true when catch basins drain runoff from hot spot areas.

Effectiveness

While manufacturers' literature typically reports removal rates for swirl separator design, there is actually very little independent data to evaluate the effectiveness of these products. Two studies investigated one of these products. Both studies reported moderate pollutant removal. While the product outperforms oil/grit separators, which have virtually no pollutant removal, the removal rates are not substantially different from the standard catch basin. One long term advantage of these products over catch basins is that, if they incorporate an off-line design, trapped sediment will not become resuspended. Data from two studies are presented below.

Table 4 Effectiveness of Manufactured Products for Storm Water Inlets

Study	Greb et al., 1998	Labatiuk et al., 1997
Notes	Investigated 45 precipitation events over a 9-month period. Percent removal rates reflect overall efficiency, accounting for pollutants in bypassed flows.	Data represent the mean percent removal rate for four storm events.
TSS[a]	21	51.5
TDS[a] -	21	-
TP[a]	17	-
DP[a]	17	-
Pb[a]	24	51.2
Zn[a]	17	39.1
Cu[a] -	-	21.5
PAH[a]	32	-
NO_2+NO_3[a]	5	-

a TSS=total suspended solids; TDS=total dissolved solids; TP=total phosphorus; DP=dissolved phosphorus;

Pb=lead; Zn=zinc; Cu=copper; PAH=polynuclear aromatic hydrocarbons; NO_2+NO_3=nitrite+nitrate-nitrogen

Cost Considerations

A typical swirl separator costs between $5,000 and $35,000, or between $5,000 and $10,000 per impervious acre. This cost is within the range of some sand filters, which also treat highly urbanized runoff. Swirl separators consume very little land, making them attractive in highly urbanized areas. The maintenance of these practices is relatively expensive. Swirl concentrators typically require quarterly maintenance, and a vactor truck, the most common method of cleaning these practices, costs between $125,000 and $150,000. This investment is not feasible for exclusive use in the Buena Vista and Timber Ridge Estates communities or other areas where limited storm sewer systems are in place at this time. However, there may be future application for this type of best management practice as residential development continues and infrastructure systems are upgraded. This alternative may become more feasible as initial costs can be divided and applied to more units within a community. As adjacent communities develop and upgrade their systems, it may be possible to share a vactor truck with another community. Depending on the rules within a community, disposal costs of the sediment captured in swirl separators may be significant.

3.3 Boat Operation Management

No wake zones, motorized craft restrictions, and sign and buoy placement are widely used practices for protecting shallow-water habitats. Important aquatic vegetation should be protected from damage due to boat and personal watercraft propellers because of its ecological importance and value in preventing shoreline erosion. This management measure presents effective, easily implemented practices for protecting aquatic vegetation and shorelines.

Boat traffic (including personal watercraft) through shallow-water areas and in nearshore areas at wake-producing speeds can resuspend bottom sediment, uproot submerged aquatic vegetation, erode shorelines, and harm some animals, including manatees. Resuspended sediment and erosion along shorelines increases turbidity in the water column. Turbid waters can't support submerged aquatic vegetation to the same depths as clear waters because sunlight can't penetrate to as great a depth. With photosynthesis limited to the upper foot or so of water, less dissolved oxygen is produced.

Fish that locate prey primarily by sight have a harder time finding prey in turbid waters. Plant leaves can become coated with fine sediment, and bottom-dwelling organisms are continually covered by resettling sediment.

Resuspended sediment can also contain harmful chemicals that were discharged at the marina or elsewhere in the watershed and had been trapped in the sediment. Once in

the water column, these chemicals are more likely to be ingested by fish and shellfish and to work their way up the food chain, possibly to someone's dinner table.

Uprooted submerged aquatic vegetation can no longer provide habitat for fish and shellfish or food for waterfowl. Instead of recycling nutrients released from matter decomposing in the waterbody, the vegetation adds more nutrients as it decomposes. It also cannot reduce wave energy at shorelines, so the shorelines become more exposed to the erosive forces of storm waves and the boat wakes that contributed to their initial loss. Replacing submerged aquatic vegetation once it has been uprooted or eliminated from an area is difficult, and the science of replacing it once it is lost is not well developed

Best Management Practices for Boaters

♦ Restrict boater traffic in shallow-water areas. To protect aquatic beds and bottom habitats, shallow-water areas can be established as "off limits" to boat traffic of any type, including personal watercraft. Signs or buoys in the water around the edges of these areas can help the public comply with shallow habitat protection efforts. Distribution of flyers with maps that show shallow areas and indicate permanent landmarks, so boaters can easily determine whether they are near shallow areas, is another effective tool. Boaters usually try to protect these habitats once they understand their ecological importance and are aware of their presence. Shallow-water habitat destruction is due more to a lack of knowledge than to negligence.

♦ Establish and enforce no wake zones to decrease turbidity, shore erosion, and damage. No wake zones are more effective than speed limits in shallow surface waters for reducing turbidity and erosion caused by boat passage. Hull shape strongly influences wake formation, allowing some boats to go fast with little wake while other boats throw a large wake at slow, nonplaning speeds. In shallow areas, larger waves from the wakes of "speed-limited" watercraft are more likely to resuspend bottom sediments and create turbid waters.

Guidelines for Responsible Personal Watercraft Operation

Personal watercraft, include jet skis and waterbikes, are propelled by waterjet drives, have shallow draft designs, and are able to achieve planning speeds (65 mph and higher). Approximately one third of all new boat sales in recent years have been personal watercraft. They are defined as Class A inboard boats by the U.S. Coast Guard and are required to follow most boating regulations. The personal watercraft industry encourages users of personal watercraft to adopt the following simple guidelines to preserve natural resources:

• Ride in main channels to avoid stirring bottom sediments; limit riding in shallow water.

• Operate away from shore as much as possible to avoid disturbing wildlife with wakes and noise and to avoid interfering with their feeding, nesting, and resting.

• Avoid aquatic beds since these are delicate ecosystems that are easily damaged.

• Avoid high speeds near the shore to minimize or eliminate your contribution to shoreline erosion.

• Wash your personal watercraft off after use and before trailering it to other waters to avoid spreading exotic, nonnative species to uninfected waters.

Applicability

This management measure is applicable to protecting the aquatic beds and the shoreline in general of Jimmerson Lake. The Jimmerson Lake Association as well as all boaters using the lake can become involved in efforts to protect sensitive aquatic habitats.

The figure below depicts areas where "NO WAKE" buoys should be installed. Four areas are designated for protection. These include:

- Buena Vista Inlet
- Lane 101D Region
- Delphi's Addition Inlet
- DNR area to Public Access Ramp

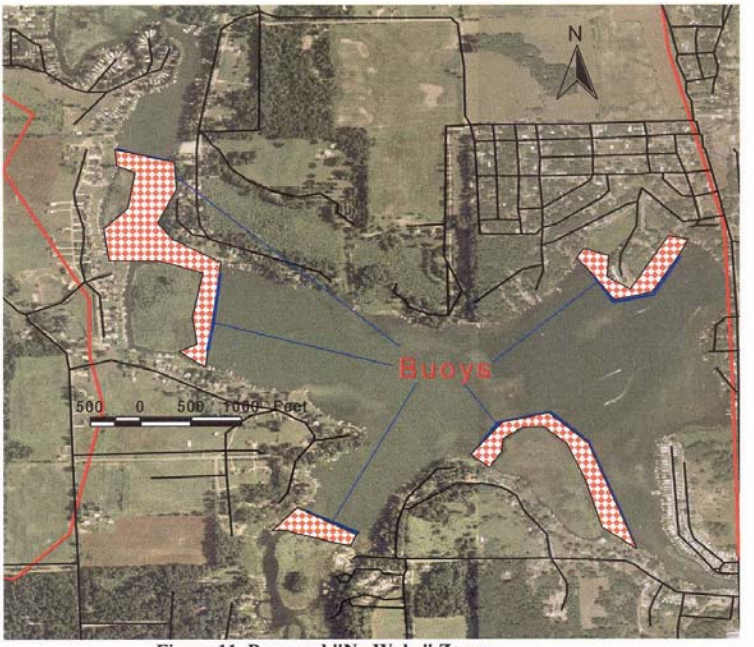

Figure 11 Proposed "No Wake" Zones

3.4 BMP Guidelines

According to EPA's Preliminary Data Summary of Urban Stormwater Best Management Practices, an urban stormwater BMP is a "technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of storm water runoff in the most cost-effective manner. With ongoing research, new BMPs are constantly emerging. In fact, the term "best management practices" would be more accurately phrased as "better management practices" because what is "best" varies with each application.

3.4.1 Best Management Practices for Single-Family Residences

The actions taken each day in and around the homes in the Jimmerson Lake watershed have a profound effect on stormwater quality. Small amounts of pollution from many different sources can significantly affect Jimmerson Lake. Yard maintenance, waste storage, car washing and maintenance are some of the activities that can adversely impact water quality. The best management practices discussed in this section are practical ways to keep stormwater from becoming polluted in the first

place. It is recommended that all residences in the Jimmerson Lake watershed use these BMPs. Some of these procedures are required by various state, federal, or county laws, and are noted as required BMPs.

3.4.1.1 AUTOMOBILE WASHING

Most residents wash their cars in the driveway or on the street. Washwaters typically flow to a ditch, which discharges stormwater to a larger ditch or directly to the lake. Soaps and detergents, even the biodegradable ones, can have immediate and long-term effects on organisms living in waterbodies. The grime washed off the car also contains a variety of pollutants that can harm fish and wildlife.

Suggested BMPs

- Wash your car directly over your lawn or make sure the wash water drains to a vegetated area. This allows the water and soap to soak into the ground instead of running off and eventually flowing to Jimmerson Lake.
- Ideally, no soaps or detergents should be used, but if you do use one, select one without phosphates.
- Sweep driveways and street gutters **before** washing vehicle to clean up dirt, leaves, trash and other materials that may flow to the drainageway along with your wash water.
- Commercial products are available that allow you to clean a vehicle without water. These were developed for areas where water is scarce, so a water saving benefit is realized as well as reduced pollution.
- Use a nozzle on your hose to save water.
- Do not wash your car if rain is expected.
- Consider not washing your car at home. Take it to a commercial car wash that has a recycle system and discharges wastewater to the sanitary sewer for treatment.

3.4.1.2 AUTOMOBILE MAINTENANCE

Many of us are "weekend mechanics". We enjoy the cost savings of changing our own oil and antifreeze, topping off the battery with water, and generally making our car perform its best. There are many potentials for stormwater pollution associated with these activities, however, the following BMPs will help you minimize pollution while servicing your car.

Required BMPs

- Recycle all oils, antifreeze, solvents and batteries. Many local car parts dealers and gas stations accept used oil. Old batteries can actually be worth money. Call

shops listed under Batteries in the Yellow Pages of the phone book to find out if they are paying for used batteries.

- **Never** dump new or used automotive fluids or solvents on the ground, in a storm drain or street gutter, or in the lake. Eventually, it will make its way to the lake or groundwater, including the water we drink.
- Do not mix wastes. The chlorinated solvents in some carburetor cleaners can contaminate a huge tank of used oil, rendering it unsuitable for recycling. Always keep your wastes in separate containers which are properly labeled and store them out of the weather.

Suggested BMPs

- To dispose of oil filters, punch a hole in the top and let drain for 24 hours. This is where a large funnel in the top of your oil storage container will come in handy. After draining, wrap in 2 layers of plastic and dispose of in your regular garbage.
- Use care in draining and collecting antifreeze to prevent accidental spills. Spilled antifreeze can be deadly to cats and dogs that ingest it.
- Perform your service activities on concrete or asphalt or over a plastic tarp to make spill clean-up easier. Keep a bag of kitty litter on hand to absorb spills. Sprinkle a good layer on the spill, let it absorb for a little while and then sweep it up. Place the contaminated litter in a plastic bag, tie it up, and dispose of it in your regular garbage. Take care not to leave kitty litter out in the rain; it will form a sticky glob that is hard to clean up.
- If you are doing body work outside, be sure to use a tarp to catch material resulting from grinding, sanding and painting. Dispose of this waste by double bagging in plastic and placing in your garbage.

3.4.1.3 STORAGE OF SOLID WASTES AND FOOD WASTES

Improper storage of food and solid waste at residences can lead not only to water pollution problems, but problems with neighborhood pets and vermin as well. Following the BMPs listed below can help keep your property a clean and healthy place to live.

Suggested BMPs

- All waste containers kept outside should have lids.
- Leaking waste containers should be replaced.
- Store waste containers under cover if possible, or on grassy areas.
- Inspect the storage area regularly to pick up loose scraps of material and dispose of them properly.
- Recycle as much as you can. Look under "Recycling" in the phone book for firms which take other recyclables.

- Purchase products which have the least amount of packaging materials.
- Compost biodegradable materials such as grass clippings and vegetable scraps instead of throwing them away. Your flower beds will love the finished compost, and we won't fill up our landfills so quickly.
- A fun alternative to traditional composting is worm composting. You can let worms do all the work for you by keeping a small vermiculture box just outside your kitchen.

3.4.1.4 YARD MAINTENANCE AND GARDENING

This section deals with the normal yard maintenance activities we all perform at our homes. Over watering, over fertilizing, improper herbicide application and improper disposal of trimmings and clippings can all contribute to serious water pollution problems. Following the BMPs listed below will help alleviate pollutant runoff.

Required BMPs

- Follow the manufacturer's directions exactly for mixing and applying herbicides, fungicides and insecticides, and use them sparingly. Never apply when it is windy or when rain is expected. Never apply over water, within 100 feet of a well-head, or adjacent to streams or the lake. Triple-rinse empty containers, using the rinsate for mixing your next batch of spray, and then double-bag and dispose of the empty container in your regular garbage.
- Never dispose of grass clippings or other vegetation in or near storm drains, ditches or the lake.

Suggested BMPs

- Follow manufacturer's directions when applying fertilizers. More is not better, either for your lawn or for the lake. Never apply fertilizers over water or adjacent to ditches or the lake. Remember that organic fertilizers have a slow release of nitrogen, and less potential to pollute than synthetic fertilizers.
- Save water and prevent pollution problems by watering your lawn sensibly. Lawns and gardens typically need the equivalent of 1" of rainfall per week. You can check on how you're doing by putting a wide mouth jar out where you're sprinkling, and measure the water with a small plastic ruler. Over watering to the point of runoff can carry polluting nutrients to the lake.
- Consider planting a vegetated buffer zone adjacent to streams or the lake on your property.
- Make sure all fertilizers and pesticides are stored in a covered location. Rain can wash the labels off of bottles and convert 50 lbs. of fertilizer into either a solid lump or a river of nutrients.

- Compost all yard clippings, or use them as mulch to save water and keep down weeds in your garden.
- Practice organic gardening and virtually eliminate the need to use pesticides and fertilizers. Contact the Steuben County Cooperative Extension for information on earth-friendly gardening.
- Pull weeds instead of spraying and get some healthy exercise, too. If you must spray, use the least toxic formulations that will get the job done.
- Work fertilizers into the soil instead of letting them lie on the ground surface exposed to the next rain storm.

3.4.1.5 HOUSEHOLD HAZARDOUS MATERIAL USE, STORAGE, AND DISPOSAL

Once we really start looking around our houses, the amount of hazardous materials we have on site is a real eye-opener. Oil-based paints and stains, paint thinner, gasoline, charcoal starter fluid, cleaners, waxes, pesticides, fingernail polish remover, and wood preservatives are just a few that most of us have around the house.

When products such as these are dumped on the ground or in a storm drain, they can be washed directly to receiving waters where they can harm fish and wildlife. They can also infiltrate into the ground and contaminate drinking water supplies. The same problem can occur if they are disposed of with your regular garbage; the containers can leak at the landfill and contaminate groundwater. The same type of contamination can occur if hazardous products are poured down a sink or toilet into a septic system. Don't pour them down the drain if you're on municipal sewers, either. Many compounds will "pass through" the wastewater treatment plant without treatment and contaminate receiving waters, or they can harm the biological process used at the treatment plant, reducing overall treatment efficiency.

With such a diversity of hazardous products present in all homes in the Jimmerson Lake watershed, a large potential for serious environmental harm exists if improper methods of storage, usage and disposal are employed. Using the following BMPs will help keep these materials out of our soils, sediments and waters.

Required BMPs

- Dispose of hazardous materials and their containers properly. Never dump products labeled as poisonous, corrosive, caustic, flammable, inflammable, volatile, explosive danger, warning, caution or dangerous outdoors, in a ditch, the lake, a storm drain, or into sinks, toilets or drains.

Suggested BMPs

- Check containers containing hazardous materials frequently for signs of leakage. If a container is rusty and has the potential of leaking soon, place it in a secondary container before the leak occurs and prevent a clean-up problem.
- Store hazardous materials containers under cover and off the ground. Keep them out of the weather to avoid rusting, freezing, cracking, labels being washed off, etc.
- Hazardous materials should be stored out of the reach of children. **Never** transfer to or store these materials in food or beverage containers which could be misinterpreted by a child as something to eat or drink.
- Keep appropriate spill cleanup materials on hand. Kitty litter is good for many oil-based spills.
- Ground cloths and drip pans must be used under any work outdoors which involves hazardous materials such as oil-based paints, stains, rust removers, masonry cleaners, and others bearing label warnings as outlined above.
- Latex paints are not a hazardous waste, but are not accepted in liquid form at the landfill. To dispose, leave uncovered in a protected place until dry, then place in the garbage. If you wish to dry waste paint quickly, just pour kitty litter in the can to absorb the paint. Once paint is dry, leave the lid off when you place it in the garbage so your garbage collector can see that it is no longer liquid.
- Use less toxic products whenever possible.
- If an activity involving the use of a hazardous material can be moved indoors out of the weather, then do so. Make sure you can provide proper ventilation, however.
- Follow manufacturers' directions in the use of all materials. Over-application of yard chemicals, for instance, can result in the washing of these compounds into the lakes. Never apply pesticides when rain is expected.
- When hazardous materials are in use, place the container inside a tub or bucket to minimize spills.

3.4.2 Best Management Practices for Construction Sites

With the onset of the National Pollutant Discharge Elimination System Phase II stormwater rule requirements for construction and post construction best management practices (BMPs), professionals, contractors, and end users are struggling to develop a systematic and logical method for selecting the appropriate BMPs to be integrated into the various construction phases of their projects. Currently, widespread confusion exists regarding selection of the best options for a particular site. As a result, many projects end up with inappropriate BMPs for the applications and issues that they are attempting to deal with.

Most regulators have two primary concerns that underlie stormwater requirements in the site-plan approval processes. These are the control of water quantity and treatment for quality both during and after the active construction phase. Water-quantity outputs from sites generally are limited to predevelopment levels. Water-quality issues focus on reducing contaminants from runoff prior to their discharge from the site. Sediment is the most prevalent constituent of concern for Jimmerson Lake. Understanding what types of structural BMPs are available and how they interact with one another will help provide guidance in selecting the right mix for a specific site.

To ensure maximum benefit is achieved, planners should assess and evaluate various BMPs for the preconstruction, active construction, and post construction phases to make sure their plans are approved in a timely and cost-effective manner and that they include the most appropriate BMPs for a specific application.

3.4.2.1 Preconstruction

The preconstruction phase requires a careful assessment of the specific site. The first step is to gain a clear understanding of what stormwater controls will be required by relevant stormwater regulations, local ordinances, and site-plan approval processes. Nearly all regulations will require controls during the active construction phase to control sediment and limit runoff from the site to ensure minimum impacts on downstream receiving waters. The primary construction concern is sediment control, and a wide range of both temporary and permanent BMPs will be needed. Each application must be examined to determine site-specific needs for laying out the sequence of selecting both temporary and permanent BMPs. This sequence is commonly referred to as the "treatment train," and a clear understanding of all available options is critical for a successful site plan.

Several factors must be considered in devising an effective classification of BMPs to assist planners and end users in the assessment and selection process. First is the proposed land use of a project. Possible uses include industrial, commercial, residential, and streets and highways. For each use, the specific site application needs must be determined. Consideration should be given to whether the project is new or redevelopment and how much land will be available for BMP installations. A detailed review of lake concerns, along with an analysis of the site's potential to generate pollutants of concern both during and after construction, also must be completed prior to BMP selection.

Once a review of the land use and lake concerns is completed, an assessment of the appropriate BMP options can be evaluated. The wide range of BMP options can be organized into several classifications by determining what each BMP can

accomplish. Many are designed to control erosion and contain sediment transport. These are particularly important in the active construction phase where site stabilization has not yet occurred. Some BMPs can and should be installed before construction. Sediment containment devices, such as silt fences, continuous berms, and turbidity barriers, often are mandated and installed before construction commences. Other BMPs deal with controlling the quantity of runoff that will occur as a result of construction activities and post construction changes in flow that will result from increased imperviousness on the completed site. Finally, many different types of BMPs focus on water quality by treating the runoff to reduce other pollutants that are generated during the construction and post construction phases.

Another consideration is how maintenance will be performed over the long run. Planners need to think of BMP selection as a revolving process of installation, inspection, maintenance, and enforcement. Decision-makers need to consider these factors to ensure long-term performance of BMPs. Many techniques and technologies involve lower up-front costs, but installation and maintenance costs over time must be factored into the equation.

Many quality and quantity issues can be resolved through efficient site designs that incorporate practices that prevent the transport of water and pollutants from increasing as a result of development. These preventive measures can greatly reduce the need for reactive designs and technologies that are needed to contain water and remove pollutants of concern. This section focuses on the organization and classification of structural BMPs and related stormwater treatment devices (SWTDs), which are structural or nonstructural BMPs that positively impact stormwater quality before, during, or after construction or construction-related land-disturbing activities. SWTDs might be temporary or permanent, depending on their desired application or function. SWTDs might be "proactive" or "reactive" in their approach or application. Examples of proactive SWTDs include erosion control practices, green roofs, vegetative filter strips, and rain barrels. Reactive techniques might employ sediment control practices, inline treatment devices, sedimentation ponds, and detention/retention systems.

3.4.2.2 Active Construction

Sediment Containment Systems

The role of sediment control systems is to create conditions for sedimentation, allowing soil particles that are held in suspension to settle. When soil-particle transport mechanisms flow at slow rates, particles can settle out of suspension. How deposition occurs depends on several parameters.

Sediment control systems generally are hydraulic controls that function by modifying the storm-runoff hydrograph and slowing water velocities, allowing for the deposition of suspended particles by gravity. Some of the more common names for these structures are sediment basins, sediment ponds, and sediment traps. When designed correctly, sediment containment systems should provide sufficient containment storage volume to handle incoming waters, create uniform flow zones within the containment storage volume for the deposition of suspended particles, and discharge water at a controlled rate.

When all runoff waters are captured, the efficiency of the containment system is nearly 100%. Retaining all runoff waters from a construction site usually is impossible, however, because large containment areas and volumes are required. In addition, evaporation and infiltration might not be sufficient to drain the system before the next storm event occurs, which might cause flooding problems. Finally, retained waters might hamper maintenance of the system because removing captured sediments becomes more complicated with the presence of water.

Because of these concerns, rather than attempting to retain all runoff waters, a containment system should provide sufficient volume for capturing suspended particles while allowing discharge to occur. This provides the advantage of detaining incoming runoff to control the discharge of suspended particles while not requiring large areas to store runoff waters. Flooding problems from sequential storm events are reduced because contained waters usually will be drained from the system between events. Finally, frequent maintenance is facilitated because the sediments do not remain saturated with water.

Documentation on the effectiveness of containment systems for trapping suspended solids is limited, and there are conflicting opinions on their actual effectiveness. If properly designed, constructed, inspected, and maintained, however, containment systems are effective in trapping sediment.

This discussion focuses on selected manmade, nonstructural sediment-containment systems that act as barriers or filters. A barrier is any structure that obstructs or prevents the passage of water. If runoff cannot pass through a barrier, then water will either be contained or flow over the structure. Commonly used manmade barrier devices include silt fences, continuous geotextile-wrapped berms, wattles, turbidity barriers, and geosynthetic silt dikes. Because their effectiveness is minimal for large runoff events, these devices must be carefully installed, and their usefulness generally is limited to low-volume flows from smaller storm events. As such, these systems are typically only used and installed during the preconstruction and active-construction phases of a project.

Appropriate places to use sediment control barriers include:

- along sections of a site perimeter
- below disturbed areas subject to sheet and rill erosion,
- below the toe of exposed and erodible slopes,
- along the toe of stream and channel banks,
- low-flow swales and ditches,
- around area drains or inlets located in a sump.

Inappropriate places to use sediment control barriers include:

- parallel to a contour when installed on a hillside;
- in channels where concentrated flows occur, unless properly reinforced;
- upstream or downstream of culverts where concentrated flows occur;
- in front of or around inlets where concentrated flows occur and sump conditions do not exist;
- in continuously flowing streams or ephemeral channels.

Filtration Devices

Other SWTDs used during active construction are designed to provide sediment containment and/or filtration. These might include geotextile catch basin inserts, geosynthetic drainage and curb inlet filters, geotextile tubes, and geotextile filter bags. These materials allow water to flow through them while filtering or capturing sediment. Selecting the correct geotextile or fiber consistency will reduce the possibility of blinding or clogging the device with excessive sediment.

Appropriate places to use geosynthetic filters include in front of or around gutters and drain inlets where sump conditions exist and in areas of dewatering of detention/retention ponds or dredging of construction and/or industrial spoils.

Inappropriate places to use geosynthetic filters include in front of or around inlets where concentrated flows occur and sump conditions do not exist, in channels where concentrated flows occur, and in continuously flowing streams or ephemeral channels.

Manmade geosynthetic SWTDs and filters have numerous advantages over traditional sediment control practices derived from natural materials. They usually are easier to transport, install, and maintain as compared to straw and hay bales or soil and rock structures. Manufacturing and fabrication consistencies enable the performance of geosynthetic devices to be more predictable and generally superior to that of natural materials. In some cases these devices may be washed and reused.

3.4.2.3 Post construction

Post construction structural BMPs are techniques that can be used to address flow quantity control of and treatment for water quality through pollutant removal in wet-weather runoff. These BMPs can include site-specific engineered designs as well as proprietary systems. The challenge with any attempt to organize or classify BMPs by type or function is that many fit into multiple categories. In the interest of clarity, however, structural BMPs can be grouped into several classifications by function, including the following:

- Infiltration systems
- Detention systems
- Retention systems
- Vegetated systems
- Filtration systems
- Hydrodynamic separation systems

A clear understanding of the post construction BMP options will help clarify the assessment and selection process for meeting active construction and post construction requirements.

The balance of this section presents a proposed matrix system for selecting appropriate manufactured stormwater treatment devices for specific site application needs during all phases of the construction process.

Functions of Manufactured SWTDs

Basic functions of manufactured SWTDs can be grouped into five major categories. These are sediment containment, filtration, separation, infiltration, and underground detention. Although it is beyond the scope of this study to describe and classify all the types of BMPs that might be used to fulfill these functions, various manufactured SWTDs may be grouped by primary function, as shown in Table 5.

Table 5 Basic Functions of Stormwater Treatment Devices

Sediment Containment	
Silt Fences	Channel Silt Dikes
Continuous Berms	Turbidity Barriers
Wattles	Geotextile Filter Bags
Drain Inlet Barriers	Geotextile Tubes
Filtration	
Catch Basin Inserts	
Type I - Geotextile Filtration Systems	
Type II - Multichamber Permanent Structures	
Curb Inlet Filters	
Type I - Exterior - Geotextile Filtration Systems	
Type II - Interior - Multichamber Permanent Filtration Systems	
Separation	
Hydrodynamic Separation Devices	
Infiltration	
Infiltration Chamber Systems	
Detention	
Underground Piping Systems	

Once the function required of an SWTD has been determined, it is time to consider when and where it should be employed. Failure to properly install an SWTD in the correct location or sequence of a land-disturbing activity might result in failure or compromised performance.

After the appropriate application or function of the required stormwater treatments has been determined, these parameters may be coupled to facilitate selection of the most appropriate SWTD. Table 6 presents a matrix that combines function with construction phases for identifying potential SWTDs for selection consideration.

Table 6 Function and Typical Construction Phase(s) for Applying Manufactured Stormwater Treatment Devices

Function	**Construction Phase**		
	Preconstruction	*Active Construction*	*Post construction*
Sediment Containment	Silt Fences Continuous Berms Turbidity Barriers	Silt Fences Continuous Berms Turbidity Barriers Catch Basin Inserts – Types I and II Drain Inlet Barriers Curb Inlet Filters – Types I and II Channel Silt Dikes Geotextile Filter Bags Geotextile Tubes	Catch Basin Inserts – Type II Curb Inlet Filters – Type II Hydrodynamic Separation Devices
Filtration		Catch Basin Inserts – Type II Curb Inlet Filters – Type II Geotextile Filter Bags Geotextile Tubes	Catch Basin Inserts – Type II Curb Inlet Filters – Type II Geotextile Filter Bags Geotextile Tubes Hydrodynamic Separation Devices
Separation			Hydrodynamic Separation Devices
Infiltration			Infiltration Chamber Systems
Detention			Underground Piping Systems

Finally, where to use an SWTD must be considered. Although it is beyond the scope of this article to present specific site locations for the vast potential variances of SWTD applications, Table 7 presents a matrix coupling site location with the various construction phases. Combining Tables 6 and 7 might help end users make informed decisions when considering SWTDs for various functions, construction phases, and site locations.

Table 7 Site Location and Typical Phase(s) of Construction for Applying Manufactured Stormwater Treatment Devices

Site Location	Construction Phase		
	Preconstruction	*Active Construction*	*Post construction*
Perimeter	Silt Fences Continuous Berms	Silt Fences Continuous Berms	
Catch Basin Inlet, Curb Inlet		Catch Basin Inserts – Types I and II Drain Inlet Barriers Curb Inlet Filters – Types I and II Hydrodynamic Separation Devices	Catch Basin Inserts – Type II Curb Inlet Filters – Type II Hydrodynamic Separation Devices
Channel		Channel Silt Dikes	
Slopes	Silt Fences Continuous Berms Wattles	Silt Fences Continuous Berms Wattles	
Waterway	Turbidity Barriers	Turbidity Barriers Geotextile Tubes	Geotextile Tubes
Sediment Basin/Trap		Geotextile Filter Bags	Geotextile Filter Bags
Below Impervious Surfaces		Infiltration Chamber Systems Underground Piping Systems	Infiltration Chamber Systems Underground Piping Systems

To ensure that regulators, planners, engineers, and contractors have a clear picture of what techniques and measures can be used in the various construction phases for proper BMP management, a solid understanding of the options is essential. By classifying the various sediment controls and post construction BMPs into proper applications, stormwater professionals are far more likely to develop efficient yet cost-effective stormwater plans for specific projects. A thorough understanding of the installation, inspection, maintenance, and enforcement requirements also will result in a more comprehensive and realistic cost analysis of the project. The result will be cleaner water and a more satisfied general public.

4.0 RECOMMENDATIONS

4.1 Sediment Basin

The eastern component of the drainageway, in Section 5, is largely an open valley that receives runoff from approximately one hundred fifty acres. Nearly 90% of this is agricultural land and the remainder is pasture and forested land. Nearly all of the agricultural land, except for the Brookston loam, is potentially highly erodible and nearly ten acres of the subwatershed is highly erodible.

Properly designed and maintained sediment basins can be very effective in preventing sedimentation of downstream areas. Coarse and medium size particles and associated pollutants will settle out in the basin. Suspended solids, attached nutrients, and absorbed non-persistent pesticides may break down before proceeding downstream. Because sediment basins also retain water, they may help recharge the ground water.

Although erosion control should always be considered first, in those situations where physical conditions or land ownership prevents implementation of erosion control measures, sediment basins offer the most practical solution to the problem. It is practical and economical to locate sediment basins where the largest storage capacity can be obtained with the least amount of earth work, such as in natural depressions and drainage ways. A sediment basin is an alternative for consideration in this drainageway.

The peak runoff rate (Q), based on a 10-year reoccurrence frequency, is calculated to be approximately 80 cubic feet per second (cfs) for this subwatershed. The surface area requirement in acres (A) is calculated by the formula:

$A = 0.01 \times Q$

Therefore;

$A = 0.01 \times 80 = 0.8$ acres

Configuring the basin with a L = 2.5 W ratio, the W is calculated:

0.8 acres = 34,850 ft^2 = 2.5 W^2

14,000 ft^2 = W^2

120 ft = W

The length is then calculated

L = 2.5 W = 300 ft

The result is a basin with surface dimension of 300 feet by 120 feet.

The minimum volume of the basin to address water quality should be equal to 0.5 inches of runoff from the entire contributing watershed. The volume can be calculated then by:

Cubic feet = 0.5 in/A x 150 A x ft/12 in x 43,560 ft2/A

= 272,250 or 6.25 acre-feet

The required depth to obtain this volume is:

6.25 acre-feet/ 0.8 acre = 8 feet

4.2 Conservation Easement

In Pleasant Township, the west component, there are depressional areas that have developed into significant wetland areas. Landward of these areas are forested areas that are generally pristine. However, this tract is scheduled for development and has been platted as the Timber Ridge Estates subdivision. Building lots have been sold for single-family home construction which will result in disturbance to the soils. Nearly all of the soil map units in this subwatershed are either highly erodible or potentially highly erodible.

The existing wetland systems play an integral role in protecting and preserving the quality of the runoff from this inlet as it reaches the lake. It is of primary importance that the in-place wetland systems be preserved to allow them to continue to pre-treat runoff before it enters the lake. Secondly, the wetlands need to be protected from overloading by sediment laden runoff that can occur when future building lots are disturbed. These wetlands can sustain serious and permanent damage if erosion and

sediment control practices are not developed and carefully implemented when building lots are disturbed. An alternative for consideration is the purchase of the wetland areas by the Jimmerson Lake Association to insure the preservation and protection of these resources.

Since this area has already been subdivided and lots sold, a more realistically attainable alternative is procuring a conservation easement on the wetland area.

A conservation easement is a legal agreement a landowner makes to limit the type and amount of development on his property. This is a granting of rights associated with adding improvements to property or otherwise changing its use or character. It is a conservation restriction. It is established with recorded deed restrictions. The restrictions are flexible, and they may be tailored to the needs of individual landowners. However, these restrictions attach to the land and are forever, except for special instances. The land may go from owner to owner, but conservation restrictions must be enforced.

Based on a review of the available plat records at the Steuben County Courthouse, the wetland is on lots 13 and 14 of the Timber Ridge Estates Subdivision. The owners of record are identified as Thomas K & Susan Miller and Luanna Oberlin respectively. More information on conservation easements is included in the Appendix.

4.3 Boat Operation Management

This management measure is applicable to protecting the aquatic beds and the shoreline in general of Jimmerson Lake. The Jimmerson Lake Association as well as all boaters using the lake can become involved in efforts to protect sensitive aquatic habitats.

"NO WAKE" buoys should be installed. Four areas are designated for protection. These include:

- Buena Vista Inlet
- Lane 101D Region
- Delphi's Addition Inlet
- DNR area to Public Access Ramp

4.4 BMPs

4.4.1 Homeowners

The Jimmerson Lake Association is encouraged to implement a public education program to distribute educational materials to the residents of the Jimmerson Lake watershed or conduct equivalent outreach activities about the

impacts of storm water discharges on water bodies and the steps that the public can take to reduce pollutants in storm water runoff.

4.4.2 Construction Sites

Erosion and sedimentation from construction sites can lead to reduced water quality and other environmental degradation. Municipalities can enact erosion and sediment control ordinances for construction sites. These local regulations are intended to safeguard the public, protect property, and prevent damage to the environment.

Ordinances promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land. Erosion and sediment control ordinances consist of permit application and review, and they can require an erosion and sediment control plan. A number of communities have dealt with construction sites by using an ordinance requiring permits, review and approval, ESC plans, design requirements, inspections, and enforcement. A model ordinance is included in the Appendix.

5.0 FUNDING SOURCES

The following section lists funding sources that may be available for use in implementing a comprehensive storm drain maintenance and filtration plan. The list may not be all-inclusive, but every attempt has been made to include sources that may be relevant for projects of this type.

Lake and River Enhancement Program (LARE)

This is the program that funded this feasibility study. The Indiana Department of Natural Resources, Division of Soil Conservation administers the LARE Program. The program's main goals are to control sediment and nutrient inputs to lakes and streams and prevent or reverse degradation from these inputs through the implementation of corrective measures. Under its current policy, the LARE program may fund lake and watershed specific construction actions up to $100,000 for a specific project or $300,000 for all projects on a specific lake or stream. Costshare approved projects require a 0-25% cash or in-kind match, depending on the project. LARE also has a "watershed land treatment" component that can provide grants to SWCDs for multiyear projects. The funds are available on a cost-sharing basis with landowners who implement various BMPs.

Clean Water Act Section 319 Nonpoint Source Pollution Management Grant

The Indiana Department of Environmental Management (IDEM), Office of Water Management, Watershed Management Section administers the 319 Grant Program. 319 is a federal grant made available by the Environmental Protection Agency (EPA). 319 grants fund projects that target nonpoint source water pollution. Nonpoint source (NPS) pollution refers to pollution originating from general sources rather than specific discharge points (Olem and Flock, 1990). Sediment, animal and human waste, nutrients, pesticides, and other chemicals resulting from land use activities such as mining, farming, logging, construction, and septic fields are considered NPS pollution. According to the EPA, NPS pollution is the number one contributor to water pollution in the United States. To qualify for funding, the water body must be: listed in the state's 305(b) report as a high priority water body, listed on the state's 303(d) list as impaired due to a nonpoint source pollutant, noted as impaired by NPS pollution in Indiana Clean Lakes Program reports, documented in the Unified Watershed Assessment for Indiana report as impacted by NPS pollution, or be identified by any other documentation as being NPS pollution affected. Funds up to $300,000 can be requested for individual projects. There is a 25% cash or in-kind match requirement.

Section 205(j) Water Quality Management Planning Grants

Funds allocated by Section 205(j) of the Clean Water Act are granted for water quality management planning and design. Grants are given to municipal governments, county governments, regional planning commissions, and other public organizations for researching point and non-point source pollution problems and developing plans to deal with the problems. According to the IDEM Office of Water Quality website: "The Section 205(j) program provides for projects that gather and map information on non-point and point source water pollution, develop recommendations for increasing the involvement of environmental and civic organizations in watershed planning and implementation activities, and implement watershed management plans. No match is required.

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APPENDIX

A. CONSERVATION EASEMENTS IN INDIANA

Communities on Course
Land Use

Conservation Easements in Indiana

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Knowledge to Go
Purdue Extension
1-888-EXT-INFO

Introduction

Landowners may grant conservation easements out of a personal desire or under a public policy to keep specific land in its current use, thus preventing its further development. A landowner may grant an easement out of charitable motives or only with compensation. If a qualified entity, under the Internal Revenue Code, acquires the easement for less than the market value of the easement, the taxpaying property owner making the grant may obtain income and transfer tax benefits.

While "easements" and "conservation" are familiar terms, a "conservation easement" is less familiar, and a relatively recent legal notion. For example, "conservation easement" is not listed among several easements defined in a 1960's law dictionary.

A conservation easement that prevents or limits the development of a land parcel for all time is contrary to common law. However, it has become the policy in many states to preserve lands indefinitely, not only for recreation, maintenance of wildlife, and scenic value, but also for maintenance of agriculture and of a way of life.

This publication covers basic and complex issues. It explains conservation easements and how the property and federal tax laws have been amended to encourage gifts of conservation easements. Public policy reflected in past and recent changes to the Internal Revenue Code make the donation of a conservation easement highly favored.

What is an easement?

An easement is a right of use over the property of another. A landowner granting an easement gives up, either for a time or permanently, certain rights in the bundle of rights that constitutes full ownership of land. A landowner may grant an easement in real estate to accommodate a neighbor by, for example, granting a right of way over his land so the neighbor may access his property. An easement may arise out of the law where a roadway is necessary to reach a landlocked parcel. Utility companies and government entities acquire easements to deliver services essential to the community or public, for example, pipelines for water or gas, electric power lines, communications cables, and roadways.

What is a conservation easement?

A conservation easement is a legal agreement a landowner makes to limit the type and amount of development on his property (Diehl and Barrett). This is a granting of rights associated with adding improvements to property or otherwise changing its use or character. It is a conservation restriction. It is established with recorded deed restrictions. The restrictions are flexible, and they may be tailored to the needs of individual

landowners. However, these restrictions attach to the land and are forever, except for special instances. The land may go from owner to owner, but conservation restrictions must be enforced.

Conservation easements are alternatives for the management of development in rural or "undeveloped" areas. Conservation easements may be gifted or sold to an appropriate private or public agency (e.g., a private land trust or to a public park service). Individuals may gift part and sell part of a conservation easement to make an arrangement feasible or practical from a financial planning point of view. (A sample form for a deed of a conservation easement may be obtained by contacting a lawyer experienced in these matters or the American Farmland Trust listed in "References & Additional Resources".)

Why use conservation easements?

Acquisition of conservation easements reduces the cost of accomplishing policy objectives. Government agencies and private land trusts may acquire full title to property to provide scenic, recreational, and other land-based benefits to the public. Government agencies may use the power of eminent domain to obtain property for public use. However, the value of a conservation easement may be only half the market value of a parcel. Cost savings from obtaining only a conservation easement (the development rights) versus paying for the full title to the property have contributed to the trend of acquiring development rights.

What are the tax benefits of donating a conservation easement?

There are four types of potential tax savings associated with donating a conservation easement: income tax, real property tax, federal gift and estate tax, and an estate tax exclusion.

Potential Income Tax Savings

Gifts of all or part of a qualified conservation easement provide a charitable income tax deduction to the contributing taxpayer. An annual deduction is limited to 30% of the donor's adjusted gross income. If the donor cannot use the whole deduction in the year of the gift, he may deduct a portion of a current gift in each of the next five years, but subject to the 30% limitation.

For example, if the fair market value of a donated conservation easement is $200,000 and the taxpayer has an adjusted gross income of $80,000, then the charitable deduction for the year of the transfer is $24,000 (30% x $80,000). This leaves $176,000 ($200,000 - $24,000) to carryover. A lifetime gift of a conservation easement does provide substantial income tax savings; however, at the $80,000 level of adjusted gross income, only $144,000 of the $200,000 would be deductible over a six-year period (6 years x $24,000/year = $144,000).

If the taxpayer is in a 28% income tax bracket, a $24,000 reduction in taxable income provides an income tax savings of $6,720 (.28 x $24,000). If that is the savings in each of six years, the tax savings is more than $40,000 (6 years x $6,720 = $40,320 [without discounting for the passage of time]). Individuals in a higher tax bracket (say 31%) would realize greater savings. Taxpayers might make gifts over several years to overcome the annual charitable deduction limitation.

Following the above example, the landowner may decide to give only half of the $200,000 and wants to receive $100,000 in cash (part sale, part gift). Part of the income tax basis of the entire parcel must be allocated to the conservation easement in a proportion equal to the value of the easement divided by the total value. If the basis on the entire parcel is $100,000, and the entire parcel is worth $400,000, then $50,000 ([$200,000 /$400,000] x $100,000) in basis must be assigned to the conservation easement. If $100,000 is received, rather than making a full gift of $200,000, the taxpayer has a gain for

income tax purposes of $50,000 ($100,000 - $50,000). A landowner, rather than take money for development rights, may trade for appropriate replacement property to defer taxable income.

Real Property Tax Savings

Because the market value of the real estate is reduced after granting a conservation easement, a real property tax savings may result. The Indiana Uniform Conservation Easement Act (at IC 32-5-2.6-7) indicates that easements under the Act must be taxed on a basis that reflects the easement's qualification under applicable tax statutes. Easements for certain wildlife habitats may be assessed at $1 per acre.

In fact, the Department of Revenue is to consider a conservation easement's effect on the assessed value of the property for property tax purposes. However, farmland assessment in Indiana is based on an agricultural-use value and not on the fair market value of the property. Thus, the granting of a conservation easement on farmland may not have a noticeable impact on the current property tax assessment.

However, changes in the administration of the real estate tax because of recent court cases involving the application of the real estate tax in Indiana could bring higher assessments for farmland. If farmland is assessed at a higher value relative to the fair market value than in the past, a conservation easement on farmland may mean a lower real estate tax.

Federal Gift & Estate Tax Savings

Conservation easements may be transferred to the appropriate charitable or government entity free of federal gift and estate taxes. The federal unified gift and estate transfer tax is based on the fair market value of property on the date of the lifetime gift or on the date of death. Amounts that qualify as charitable transfers are exempt from federal gift or estate transfer tax. Thus, land in a dece-dent's estate reduced in value by the value of a conservation easement has less exposure to the federal gift and estate tax. Recent amendments to the federal gift and estate tax law promise further savings with respect to conservation easements. The granting of a conservation easement may also reduce the Indiana inheritance tax because the inheritance tax is based on the market value of interests passing from a decedent to individual heirs.

Actual estate tax savings for a decedent's estate depends upon the taxable value of the estate and whether the tax law will otherwise allow for avoiding the estate tax. Because of the features of the estate tax, decedents' estates of small and modest values will have no federal estate tax liability. The value of property that an individual may gift or devise tax-free increased to $675,000 in 2000. This exclusion amount will increase, in steps, to $1,000,000 by 2006. Special use valuation of farmland may remove up to $770,000 (now indexed) in value of land from an estate. Finally, the new family-owned business deduction allows a deduction of up to $675,000 from a decedent's estate for federal estate tax purposes. These three features permit an individual who is in a farming business (or whose family is in farming in the case of the retired individual) to avoid the federal estate tax on up to $2.07 million in 2000.

Estate Tax Exclusion for Qualified Conservation Easements

Starting in 1998, a federal estate tax provision allows excluding land value from a decedent's estate if the land is subject to a qualified conservation easement (QCE). When a QCE meets the requirements of the new law, as much as 40% (or the applicable percentage) of the date-of-death land value may be excluded from the federal estate tax estate. This exclusion from the value of land applies after the value of the conservation easement is subtracted from the fair market value of the land.

Before 2001, a **location rule** limited the use of this new exclusion. Only land located: (1) in or within 25 miles of a metropolitan area as defined by the Office of Management and Budget, or (2) within 25 miles of a national park or wilderness area, or (3) within 10 miles of an Urban National Forest qualifies for this exclusion.

Indiana has numerous metropolitan areas, three national parks (Indiana Dunes National Shore, George Rogers Clark National Historical Park, and Lincoln Boyhood National Memorial), but no urban national forests.

After 2000, the qualified conservation easement may be on any land in the United States or U.S. possessions!

The maximum amount that can be excluded is the lesser of the "applicable percentage" (40% max.) or the "exclusion limit" ($100,000 in 1998, $200,000 in 1999, $300,000 in 2000, $400,000 in 2001, and $500,000 in 2002 and thereafter).

The percentage exclusion may be as high as 40%, but it is reduced by two percentage points for each percentage point (or fraction thereof) by which the value of the qualified conservation easement is less than 30% of the value of the land. For this purpose, the value of the land is determined without regard to the value of the easement, and it is reduced by the value of any retained development rights.

To illustrate the above rule, consider that a property owner died and that a qualified conservation easement was granted on his land. The fair market value of the land on the date of death before considering the conservation easement is $900,000. The value of the QCE is $200,000. First of all, the $200,000 of the QCE is fully deductible from the estate tax estate. The $200,000 value of the QCE is 22.22% of the total value of the property (before the QCE). The applicable percentage must be reduced by 16% (twice the difference between 30% and 22%). In this example, the applicable percentage equals 24% (40 -16). That leaves an exclusion amount of $168,000 (24% x $700,000). For estate tax purposes this real estate's value is $532,000 ($900,000 - $200,000 -$168,000).

An election under this exclusion is irrevocable. The income tax basis for the land that benefits from this new exclusion is reduced by the amount of the allowable exclusion. If the election to grant a conservation easement is done in an estate, there is no income tax deduction for the estate or the heirs.

What does a conservation purpose require?

Generally, for a taxpayer's qualified conservation easement to qualify as deductible for income and transfer tax purposes, the grantee agency must have a charitable or similar standing under the Internal Revenue Code and Treasury Regulations. It is essential that the acquisition agency have a "conservation purpose." According to the Treasury Regulations, one or more of the following satisfies the conservation purpose requirement:

- the preservation of land areas for outdoor recreation by, or the education of, the general public,
- the protection of a natural habitat of fish, wildlife, plants, or similar ecosystem,
- the preservation of open space (including for farming and forestry) where such preservation is:
  - -for the scenic enjoyment of the general public, or
  - -pursuant to a clearly delineated federal, state or local governmental conservation policy, and will yield significant public benefit, or
- the preservation of a historically important land area, or a certified historic structure.

How long must a conservation easement last to gain the tax benefits?

To satisfy the federal income tax charitable deduction requirements and for public policy reasons, "qualified" conservation easements must be established to last forever. The recorded restrictions that

limit the use of the land are permanent and stay with the land. The grantee agency has the responsibility and must have the resources to enforce the restrictions against any owner or tenant on the land. However, a utility or government entity might still have a valid reason to take the property (and violate the conservation easement restrictions) under the power of eminent domain.

Restrictions on real estate that last forever are contrary to common law. Indiana has adopted the Uniform Conservation Easement Act [See IC 32-5-2.6-1 to -7], which provides legality for a conservation easement in Indiana, as do similar Acts in other states. This Act also permits assignment of conservation easements between agencies and entities. For example, land trusts and similar charitable entities may acquire and sell conservation easements to state or federal agencies. A sale of easements may be an important source of capital and operating funds for land trusts.

Summary & Conclusion

Conservation easements are an important tool for managing real estate development. Indiana law was modified to permit the establishment of conservation easements to last forever. The Internal Revenue Code provides that gifts for a "conservation purpose" of "qualified real property interests" to a "qualified organization" are deductible for federal income, gift, and estate tax purposes. Another feature in the tax law allows for an additional exclusion of land value from an estate tax estate under limited circumstances.

Other features in the federal tax law, such as special use valuation of farmland and the new family-owned business interest deduction, are available for avoiding estate tax on modest farmland holdings. Further, the applicable exclusion amount available to all decedents increases to $1 million in 2006. These tax laws work to keep farmland in an agricultural use.

Land trusts and other entities exist in Indiana for acquiring and holding conservation easements. While certain land trusts exist for the purpose of preserving farmland, they may or may not accept an easement without an additional contribution to help protect the easement.

There may be few individuals willing to make substantial gifts of conservation easements. However, increased tax advantages, such as the new estate tax exclusion, and education about the tax advantages may persuade individuals and their heirs to contribute conservation easements.

In a few states, there are programs for the purchase and transfer of conservation easements. That is, where a community or other state or local government agency decides to protect farmland and open spaces, there is a systematic process for acquiring development rights and applying these rights where permitted to accomplish further development. The American Farmland Trust promotes and assists with agricultural conservation easement (ACE) programs, and is a source of information on these matters (See "References & Additional Resources".)

A federal program, Farmland Protection Program (FPP), has supplied a small amount of matching funds to leverage state and local funds in the acquisition of ACEs. The FPP is credited with encouraging at least four states (California, New Hampshire, Kentucky, and Ohio) to initiate state-level farmland protection programs. Indiana and its local governments may wish to become more involved in the management of local growth by establishing programs for acquiring ACE for the transfer of development rights.

Disclaimer: The material in this publication is intended for general education. Individuals and business and government entities who have questions about the law of the matters discussed should consult their legal counsel or other specialists and references for assistance.

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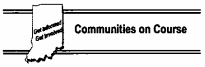

Learn more about communities, land use, growth, and how you can be involved from your local office of Purdue Extension.

References & Additional Resources

Books & Articles

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You can order Purdue Extension publications through your local county office of Purdue Extension or by calling 1-888-EXT-INFO.

You can find online versions of Purdue Extension publications on land use at <http://www.agcom.purdue.edu/AgCom/Pubs agecon.htm#30>.

REV 4/02

B. EROSION AND SEDIMENT CONTROL MODEL ORDINANCE

Erosion and Sediment Control Model Ordinance

Section I. Introduction/ Purpose

During the construction process, soil is highly vulnerable to erosion by wind and water. Eroded soil endangers water resources by reducing water quality and causing the siltation of aquatic habitat for fish and other desirable species. Eroded soil also necessitates repair of sewers and ditches and the dredging of lakes. In addition, clearing and grading during construction cause the loss of native vegetation necessary for terrestrial and aquatic habitat.

As a result, the purpose of this local regulation is to safeguard persons, protect property, and prevent damage to the environment in _____ (*municipality*). This ordinance will also promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land in _____ (*municipality*).

Section II. Definitions

Certified Contractor	A person who has received training and is licensed by _____ (*state or local environmental agency*) to inspect and maintain erosion and sediment control practices.
Clearing	Any activity that removes the vegetative surface cover.
Drainage Way	Any channel that conveys surface runoff throughout the site.
Erosion Control	A measure that prevents erosion.
Erosion and Sediment Control Plan	A set of plans prepared by or under the direction of a licensed professional engineer indicating the specific measures and sequencing to be used to control sediment and erosion on a development site during and after construction.
Grading	Excavation or fill of material, including the resulting conditions thereof.
Perimeter Control	A barrier that prevents sediment from leaving a site by filtering sediment-laden runoff or diverting it to a sediment trap or basin.
Phasing	Clearing a parcel of land in distinct phases, with the stabilization of each phase completed before the clearing of the next.
Sediment Control	Measures that prevent eroded sediment from leaving the site.
Site	A parcel of land or a contiguous combination thereof, where grading work is performed as a single unified operation.
Site Development	A permit issued by the municipality for the construction or alteration of ground

Permit	improvements and structures for the control of erosion, runoff, and grading.
Stabilization	The use of practices that prevent exposed soil from eroding.
Start of Construction	The first land-disturbing activity associated with a development, including land preparation such as clearing, grading, and filling; installation of streets and walkways; excavation for basements, footings, piers, or foundations; erection of temporary forms; and installation of accessory buildings such as garages.
Watercourse	Any body of water, including, but not limited to lakes, ponds, rivers, streams, and bodies of water delineated by_____ (*municipality*).
Waterway	A channel that directs surface runoff to a watercourse or to the public storm drain.

Section III. Permits

A) No person shall be granted a site development permit for land-disturbing activity that would require the uncovering of *10,000 or more square feet* without the approval of an Erosion and Sediment Control Plan by _____ (*erosion and sediment control agency*).

☞ *The size of the site regulated under the erosion and sediment control ordinance varies widely. The proposed Phase II of USEPA's National Pollutant Discharge Elimination System (NPDES) rules regulates disturbances greater than 1 acre, but communities may regulate sites as small as 2,000 square feet.*

B) No site development permit is required for the following activities:
   1) Any emergency activity that is immediately necessary for the protection of life, property, or natural resources.
   2) Existing nursery and agricultural operations conducted as a permitted main or accessory use.

☞ *Communities may choose to exempt other activities, such as mining, from an erosion and sediment control permit, or in some cases include the exempted uses cited above.*

C) Each application shall bear the name(s) and address(es) of the owner or developer of the site, and of any consulting firm retained by the applicant together with the name of the applicant's principal contact at such firm and shall be accompanied by a filing fee.

D) Each application shall include a statement that any land clearing, construction, or development involving the movement of earth shall be in accordance with the Erosion and Sediment Control Plan and that a certified contractor shall be on site on all days when construction or grading activity takes place.

☞ *Some states have "Certified Contractor" programs, in which contractors successfully complete a training course in basic erosion and sediment control. This person would be responsible for ensuring the regular maintenance and proper installation of erosion and sediment control measures.*

E) The applicant will be required to file with _____ (*municipality*) a faithful performance bond, letter of credit, or other improvement security in an amount deemed sufficient by _____ (*erosion and sediment control agency*) to cover all costs of improvements, landscaping, maintenance of improvements for such period as specified by _____ (*municipality*), and engineering and inspection costs to cover the cost of failure or repair of improvements installed on the site.

Section IV. Review and approval

A) _____ (*erosion and sediment control agency*) will review each application for a site development permit to determine its conformance with the provisions of this regulation. Within 30 days after receiving an application, _____ (*erosion and sediment control agency*) shall, in writing:
   1) Approve the permit application;
   2) Approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this regulation, and issue the permit subject to these conditions; or
   3) Disapprove the permit application, indicating the reason(s) and procedure for submitting a revised application and/or submission.

B) Failure of the _____ (*erosion and sediment control agency*) to act on an original or revised application within 30 days of receipt shall authorize the applicant to proceed in accordance with the plans as filed unless such time is extended by agreement between the applicant and _____ (*erosion and sediment control agency*). Pending preparation and approval of a revised plan, development activities shall be allowed to proceed in accordance with conditions established by _____ (*erosion and sediment control agency*).

Section V. Erosion and Sediment Control Plan

A) The Erosion and Sediment Control Plan shall include the following:
   1) A natural resources map identifying soils, forest cover, and resources protected under other chapters of this code.

☞ *This map should be at a scale no smaller than 1"=100'. For a more detailed discussion, see the buffer ordinance.*

   2) A sequence of construction of the development site, including stripping and clearing; rough grading; construction of utilities, infrastructure, and buildings; and final grading and landscaping. Sequencing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.
   3) All erosion and sediment control measures necessary to meet the objectives of this local regulation throughout all phases of construction and after completion of development of the site. Depending upon the complexity of the project, the drafting of intermediate plans may be required at the close of each season.
   4) Seeding mixtures and rates, types of sod, method of seedbed preparation, expected

seeding dates, type and rate of lime and fertilizer application, and kind and quantity of mulching for both temporary and permanent vegetative control measures.

5) Provisions for maintenance of control facilities, including easements and estimates of the cost of maintenance.

B) Modifications to the plan shall be processed and approved or disapproved in the same manner as Section IV of this regulation, may be authorized by (*erosion and sediment control agency*) by written authorization to the permittee, and shall include

1) Major amendments of the erosion and sediment control plan submitted to _____ (*erosion and sediment control agency*)
2) Field modifications of a minor nature

Section VI. Design Requirements

A) Grading, erosion control practices, sediment control practices, and waterway crossings shall meet the design criteria set forth in the most recent version of _____ (*erosion and sediment control manual)*, and shall be adequate to prevent transportation of sediment from the site to the satisfaction of _____ (*erosion and sediment control agency*). Cut and fill slopes shall be *no greater than 2:1*, except as approved by _____ (*erosion and sediment control agency*) to meet other community or environmental objectives.

B) Clearing and grading of natural resources, such as forests and wetlands, shall not be permitted, except when in compliance with all other chapters of this Code. Clearing techniques that retain natural vegetation and drainage patterns, as described in (*erosion and sediment control manual)*, shall be used to the satisfaction of (*erosion and sediment control agency*).

B) Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control devices have been installed and have been stabilized.

☞ *For example, the stream buffer codes as well as the forest conservation code in the "Miscellaneous Ordinances" section would also restrict clearing.*

C) Phasing shall be required on all sites disturbing greater than 30 acres, with the size of each phase to be established at plan review and as approved by (*erosion and sediment control agency*).

☞ *Although many communities encourage phasing, few actually require it. Phasing construction can reduce erosion significantly when well designed. (See Claytor, 1997.)*

D) Erosion control requirements shall include the following:

1) Soil stabilization shall be completed within *five days* of clearing or inactivity in construction.
2) If seeding or another vegetative erosion control method is used, it shall become established within *two weeks* or _____ *(erosion and sediment control agency)* may require the site to be reseeded or a nonvegetative option employed.

☞ *Numerical standards regarding the time to stabilization will vary. In particular, the time to establish seeding will depend on the climate.*

3) Special techniques that meet the design criteria outlined in (*erosion and sediment control manual)* on steep slopes or in drainage ways shall be used to ensure stabilization.
4) Soil stockpiles must be stabilized or covered at the end of each workday.
5) The entire site must be stabilized, using a heavy mulch layer or another method that does not require germination to control erosion, at the close of the construction season.
6) Techniques shall be employed to prevent the blowing of dust or sediment from the site.

☞ *Dust control is most important in arid regions of the country*

7) Techniques that divert upland runoff past disturbed slopes shall be employed.

D) Sediment controls requirements shall include
1) Settling basins, sediment traps, or tanks and perimeter controls.
2) Settling basins that are designed in a manner that allows adaptation to provide long term stormwater management, if required by _____(*erosion and sediment control agency)*
3) Protection for adjacent properties by the use of a vegetated buffer strip in combination with perimeter controls

E) Waterway and watercourse protection requirements shall include
1) A temporary stream crossing installed and approved by (*approving agency, e.g., Waterways Division, ESC agency*) if a wet watercourse will be crossed regularly during construction
2) Stabilization of the watercourse channel before, during, and after any in-channel work
3) All on-site stormwater conveyance channels designed according to the criteria outlined in _____(*erosion and sediment control manual)*
4) Stabilization adequate to prevent erosion located at the outlets of all pipes and paved channels

F) Construction site access requirements shall include
1) a temporary access road provided at all sites
2) other measures required by _____(*erosion and sediment control agency*) in order to ensure that sediment is not tracked onto public streets by construction vehicles or washed into storm drains

Section VII. Inspection

A) _____ (*erosion and sediment control agency*) or designated agent shall make inspections as hereinafter required and either shall approve that portion of the work completed or shall notify the permittee wherein the work fails to comply with the Erosion and Sediment Control Plan as approved. Plans for grading, stripping, excavating, and filling work bearing the stamp of approval of the _____ (*erosion and sediment control agency*) shall be maintained at the site during the progress of the work. To obtain inspections, the permittee shall notify _____ (*erosion and sediment control agency*) at least two working days before the following:
1) Start of construction

2) Installation of sediment and erosion measures
3) Completion of site clearing
4) Completion of rough grading
5) Completion of final grading
6) Close of the construction season
7) Completion of final landscaping

☞ *The "Certified Inspector Program" in Delaware allows developers to hire an inspector who has passed a state licensing program. This person would inspect the site at regular intervals and file reports to the erosion and sediment control agency. The agency would then be responsible for spot checks on these reports.*

B) The permittee or his/her agent shall make regular inspections of all control measures in accordance with the inspection schedule outlined on the approved Erosion and Sediment Control Plan(s). The purpose of such inspections will be to determine the overall effectiveness of the control plan and the need for additional control measures. All inspections shall be documented in written form and submitted to _____ (*erosion and sediment control agency*) at the time interval specified in the approved permit.

C) _____ (*erosion and sediment control agency*) or its designated agent shall enter the property of the applicant as deemed necessary to make regular inspections to ensure the validity of the reports filed under Section B.

Section VIII. Enforcement

A) Stop-Work Order; Revocation of Permit
In the event that any person holding a site development permit pursuant to this ordinance violates the terms of the permit or implements site development in such a manner as to materially adversely affect the health, welfare, or safety of persons residing or working in the neighborhood or development site so as to be materially detrimental to the public welfare or injurious to property or improvements in the neighborhood, _____ (*erosion and sediment control agency*) may suspend or revoke the site development permit.

B) Violation and Penalties
No person shall construct, enlarge, alter, repair, or maintain any grading, excavation, or fill, or cause the same to be done, contrary to or in violation of any terms of this ordinance. Any person violating any of the provisions of this ordinance shall be deemed guilty of a misdemeanor and each day during which any violation of any of the provisions of this ordinance is committed, continued, or permitted, shall constitute a separate offense. Upon conviction of any such violation, such person, partnership, or corporation shall be punished by a fine of not more than $_____for each offense. In addition to any other penalty authorized by this section, any person, partnership, or corporation convicted of violating any of the provisions of this ordinance shall be required to bear the expense of such restoration.

☞ *Specific penalties will vary between communities and should reflect enforceable penalties given the political realities of a jurisdiction.*

Section IX. Separability

The provisions and sections of this ordinance shall be deemed to be separable, and the invalidity of any portion of this ordinance shall not affect the validity of the remainder.

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